

FLORIDA SEA SHELLS/BY BERT
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DA
SHELLS



Susanne



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FLORIDA SEA SHELLS

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BERTHA ALDRICH AND
ETHEL SNYDER



WITH ILLUSTRATIONS

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FOR
LEE
WHO LOVES THE
'EMPIRE OF THE SUN'
AND THOUGHT THIS BOOK
A GOOD IDEA

11698

PREFACE

IN PREPARING this book the authors have endeavored to meet an ever-increasing demand for material concerning Florida shore life. We do not claim originality, but by patient search have gathered together those facts that we consider most useful to the teacher and the shell enthusiast.

Because live mollusks are so abundant on the Florida beaches, we deemed it best to include facts concerning the inhabitant of the shell as well as a description of the shell itself. Some facts concerning the use of shells have also been added for the purpose of creating interest and to show that shell collecting is not a pretty hobby alone, but may have far-reaching commercial possibilities.

We hope to acquaint those who may not be able to collect shells themselves, but who may buy them or receive them as gifts, with the joys and profits of a knowledge of the great kingdom of Mollusca. In order to limit the scope, only material pertaining to marine life has been used. The terrestrial mollusks and the fresh-water mollusks have not been included.

To Cara Byars Dawson and her children, Cara and Fielding, we express our gratitude for the many hours of patient searching and for their gallant companionship on the trail of the elusive shell.

Thanks are due to that intrepid exponent of Southern hospitality, Mrs. Bertie Sumner, of Wayside Inn, Bonita Springs, for her interest and cooperation and for the loan of her beautiful shells that made our task so much easier.

And to Mr. Ernest Schmitt many thanks for his very practical assistance and his hearty laugh that helped over so many a rough place.

We are grateful, too, to Mr. Lorin O. Thompson and Major Daniel C. Smith for their timely assistance and constant encouragement.

We acknowledge our great debt to Julia E. Rogers for *The Shell Book*, our guide and inspiration, the storehouse of shell information we have drawn upon so heavily.

To the staff members of the Miami Beach Public Library, who have endured with rare patience and fortitude the birthing of this brain child, our undying gratitude.

BERTHA ALDRICH
ETHEL SNYDER

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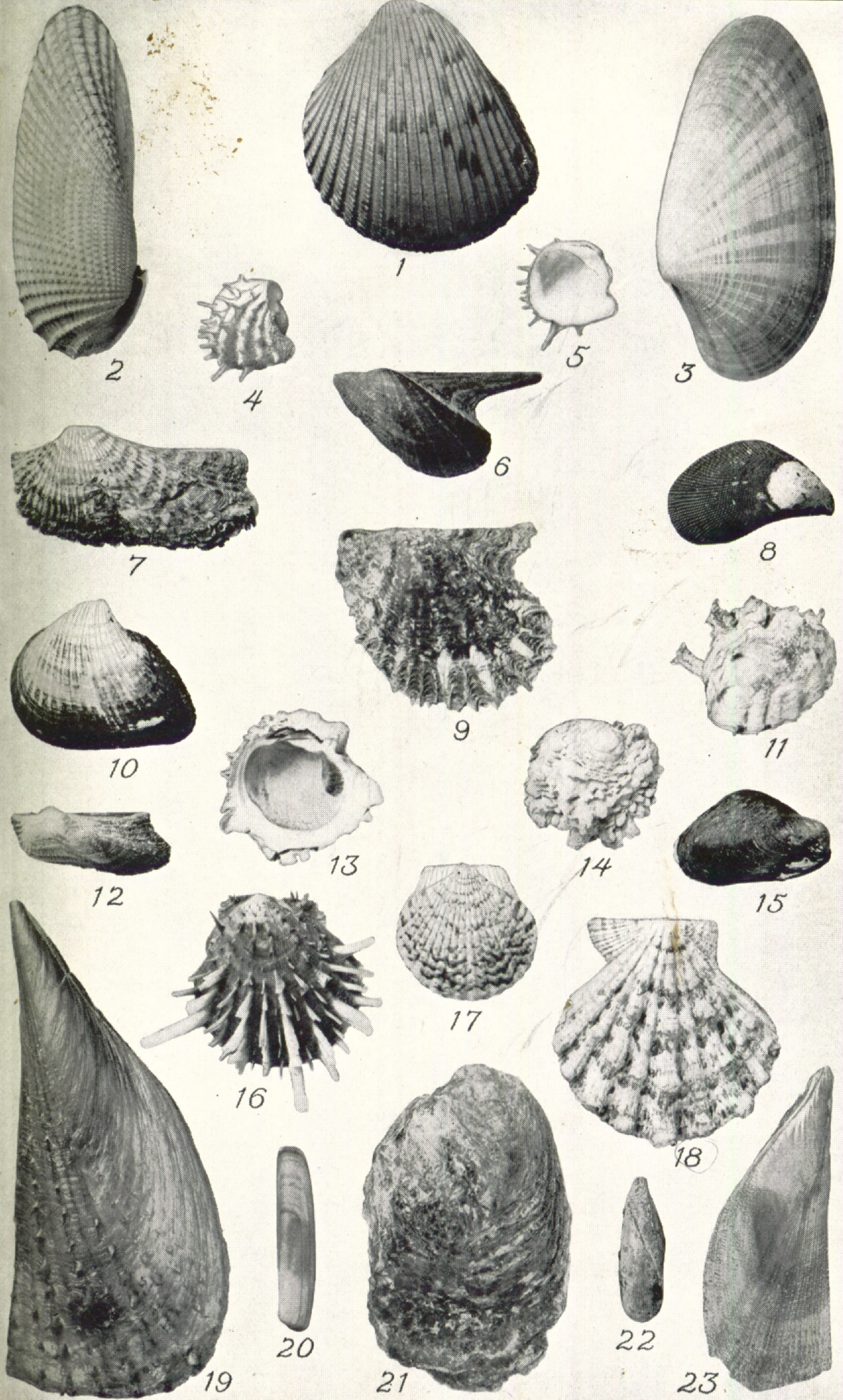


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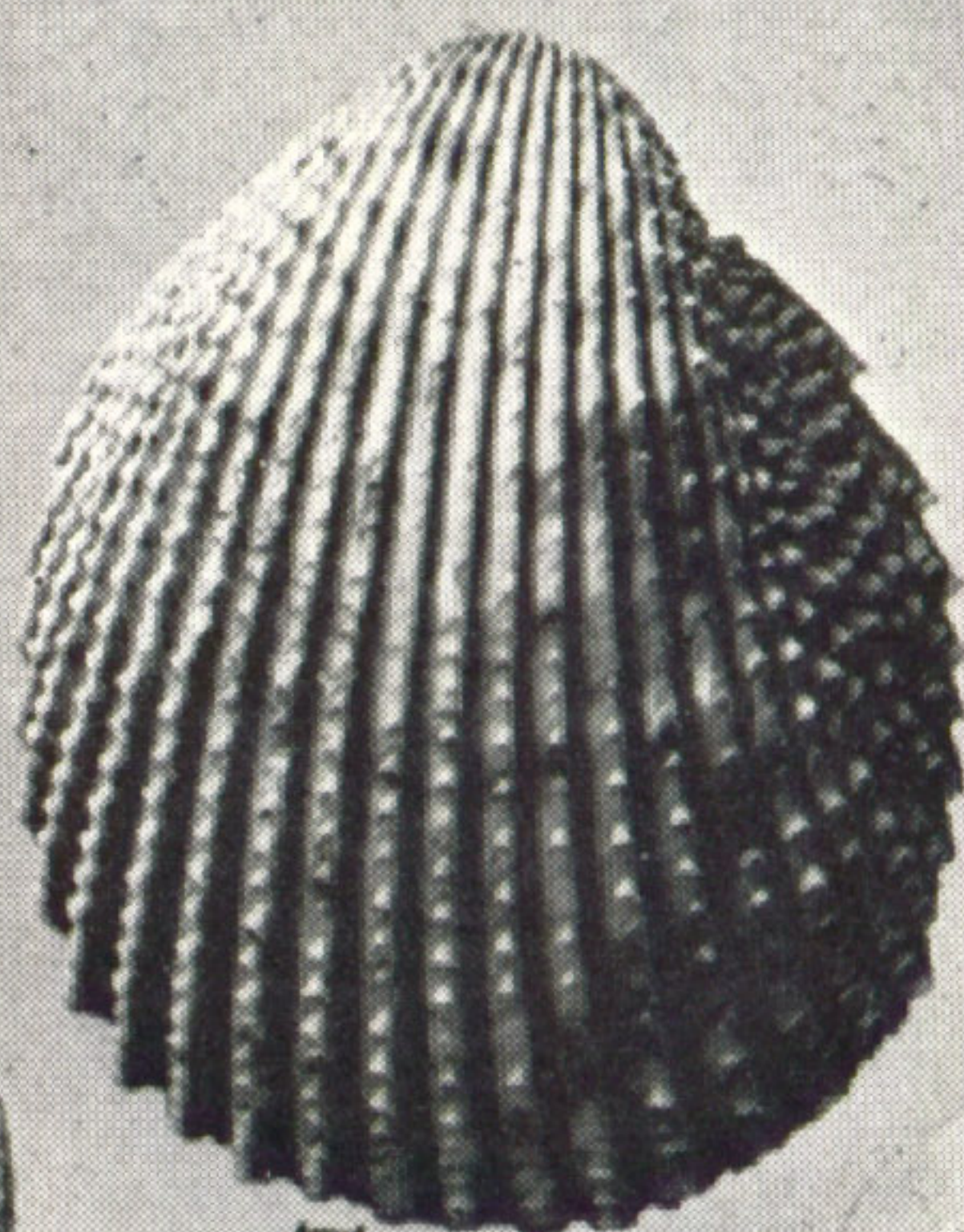
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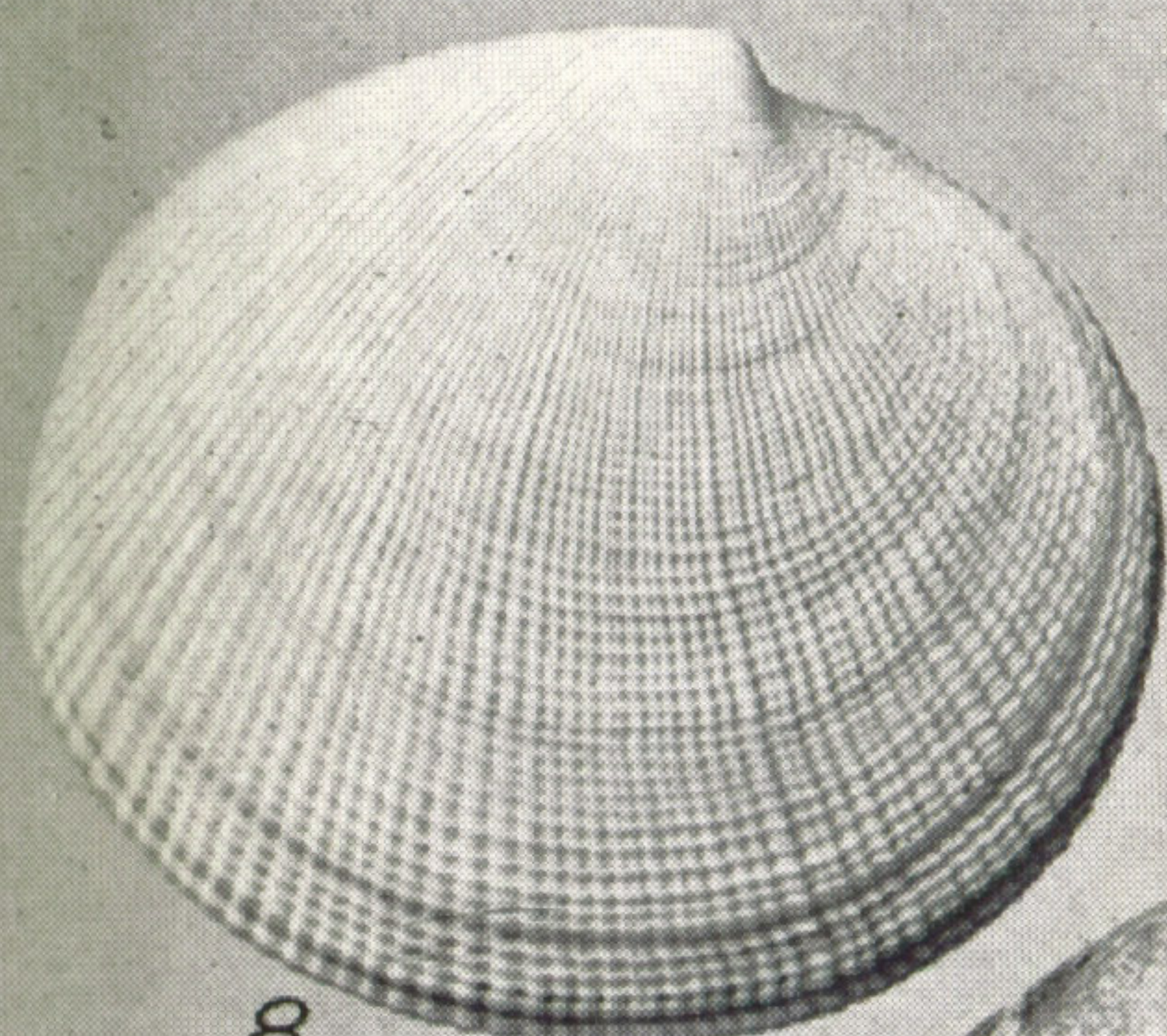
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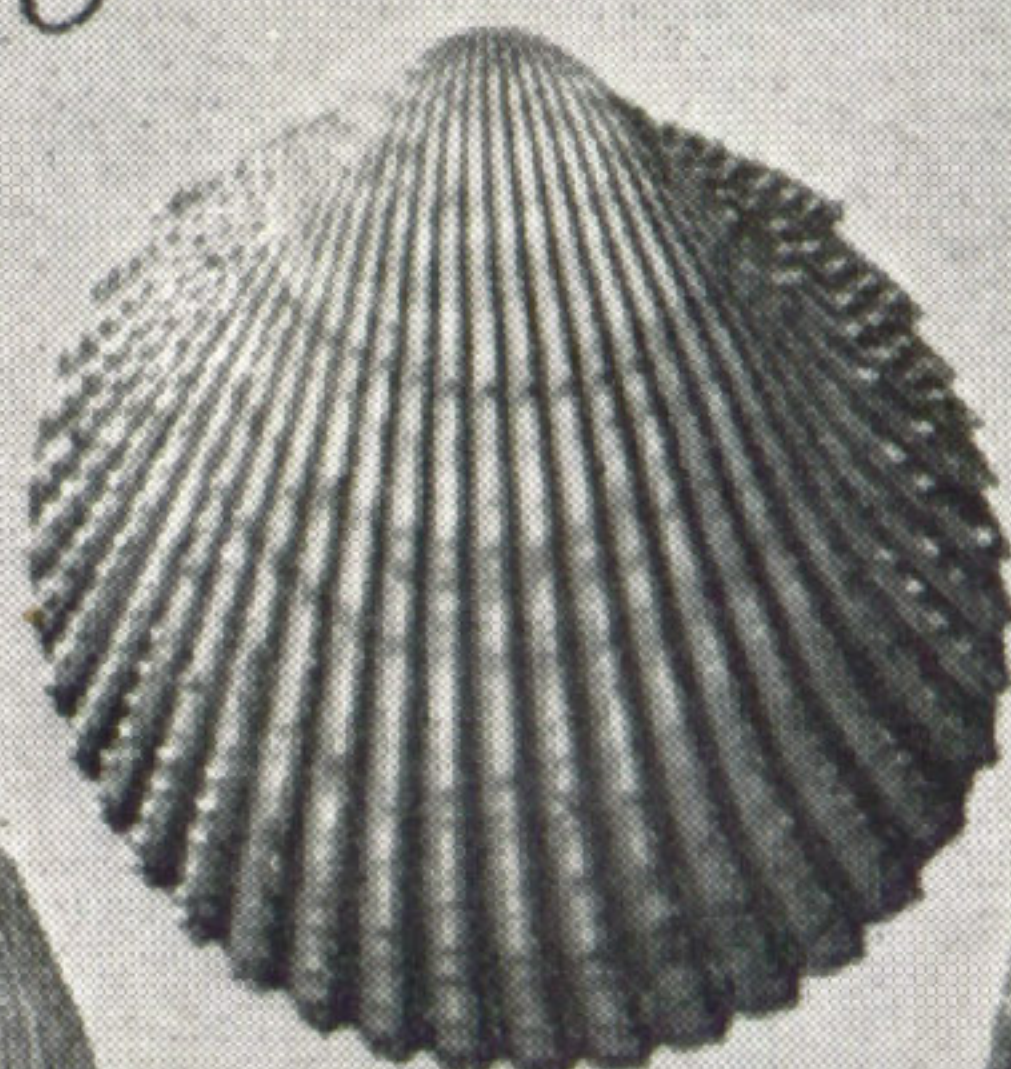
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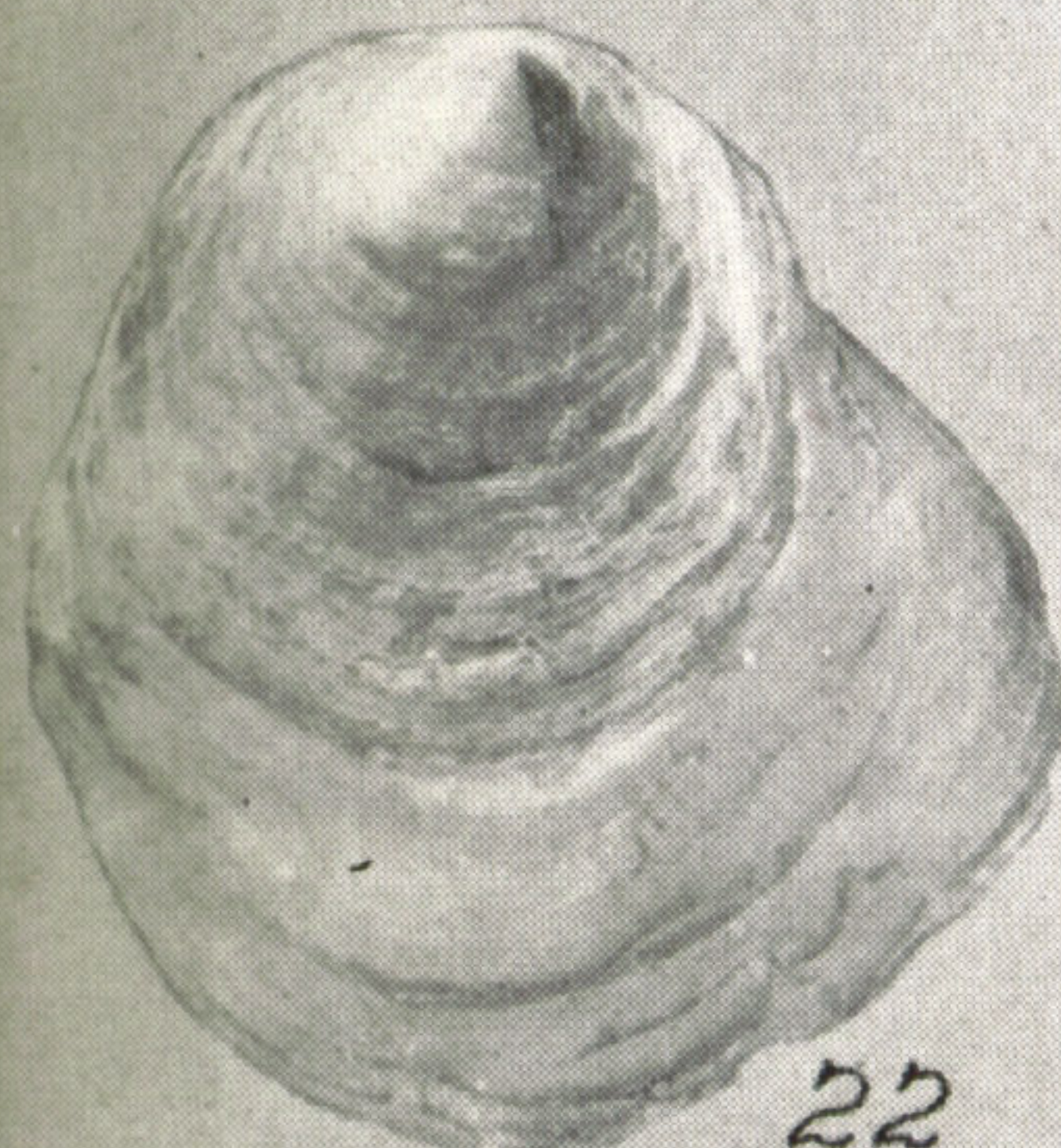
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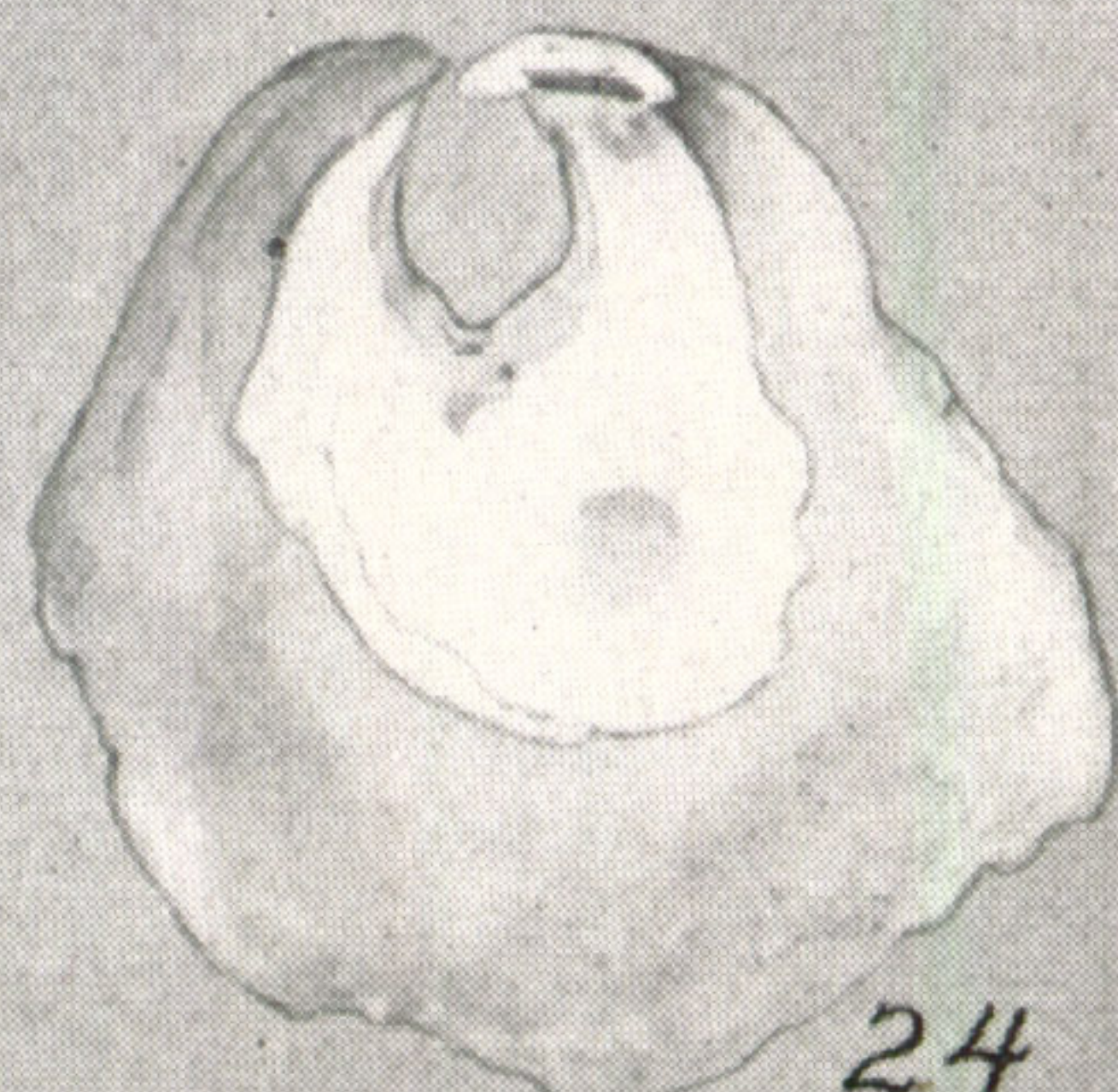
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PLATE IV (natural size)

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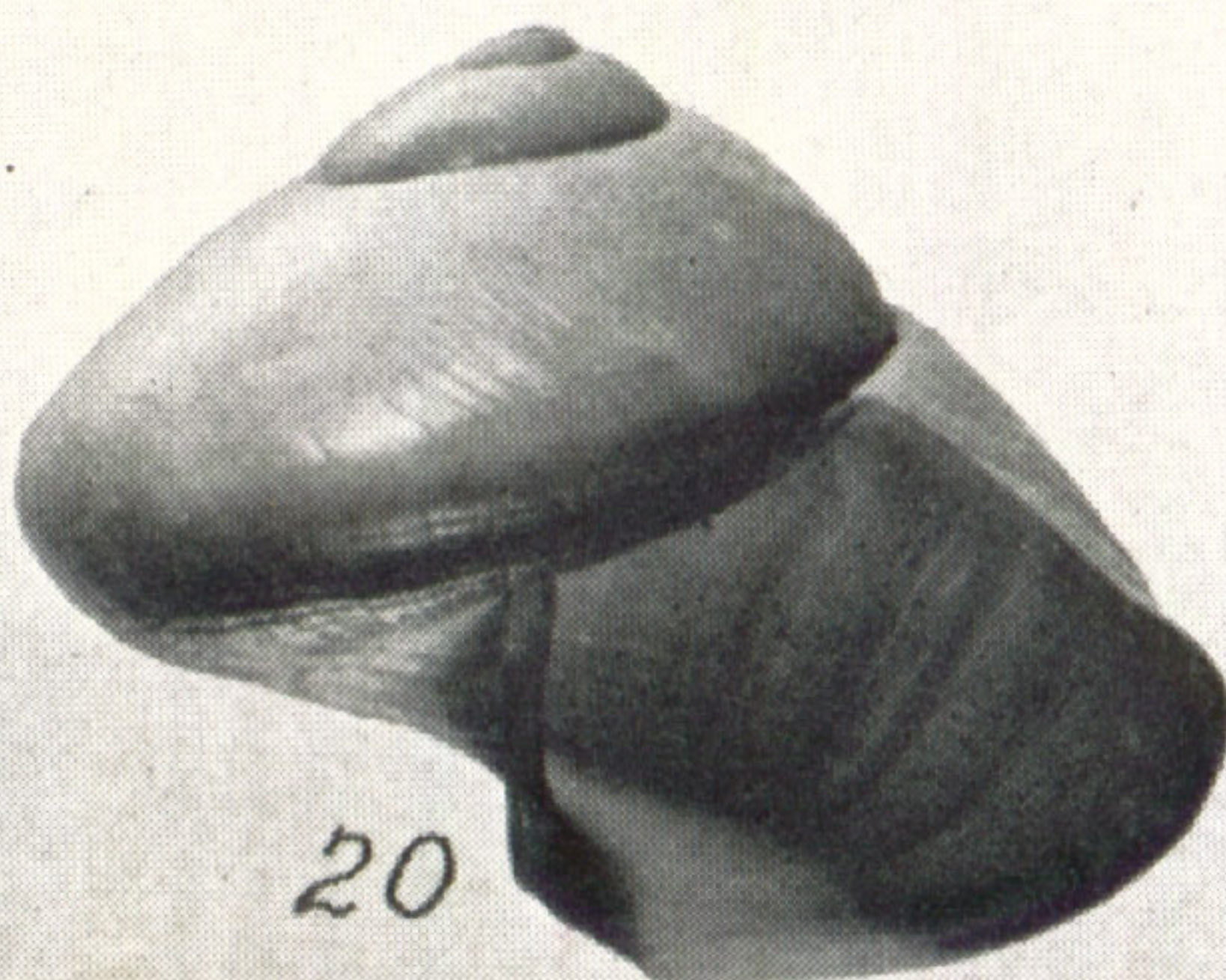
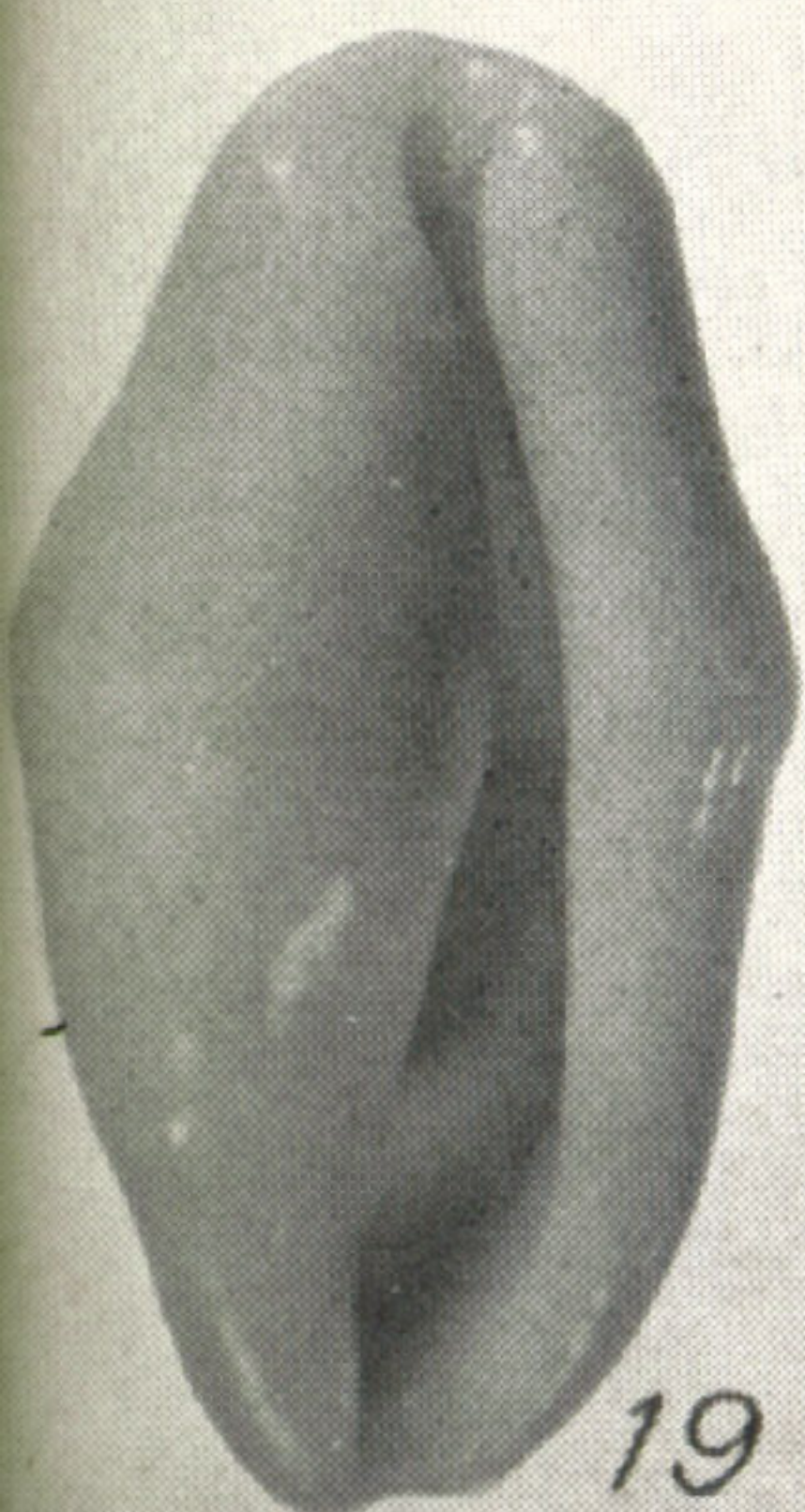
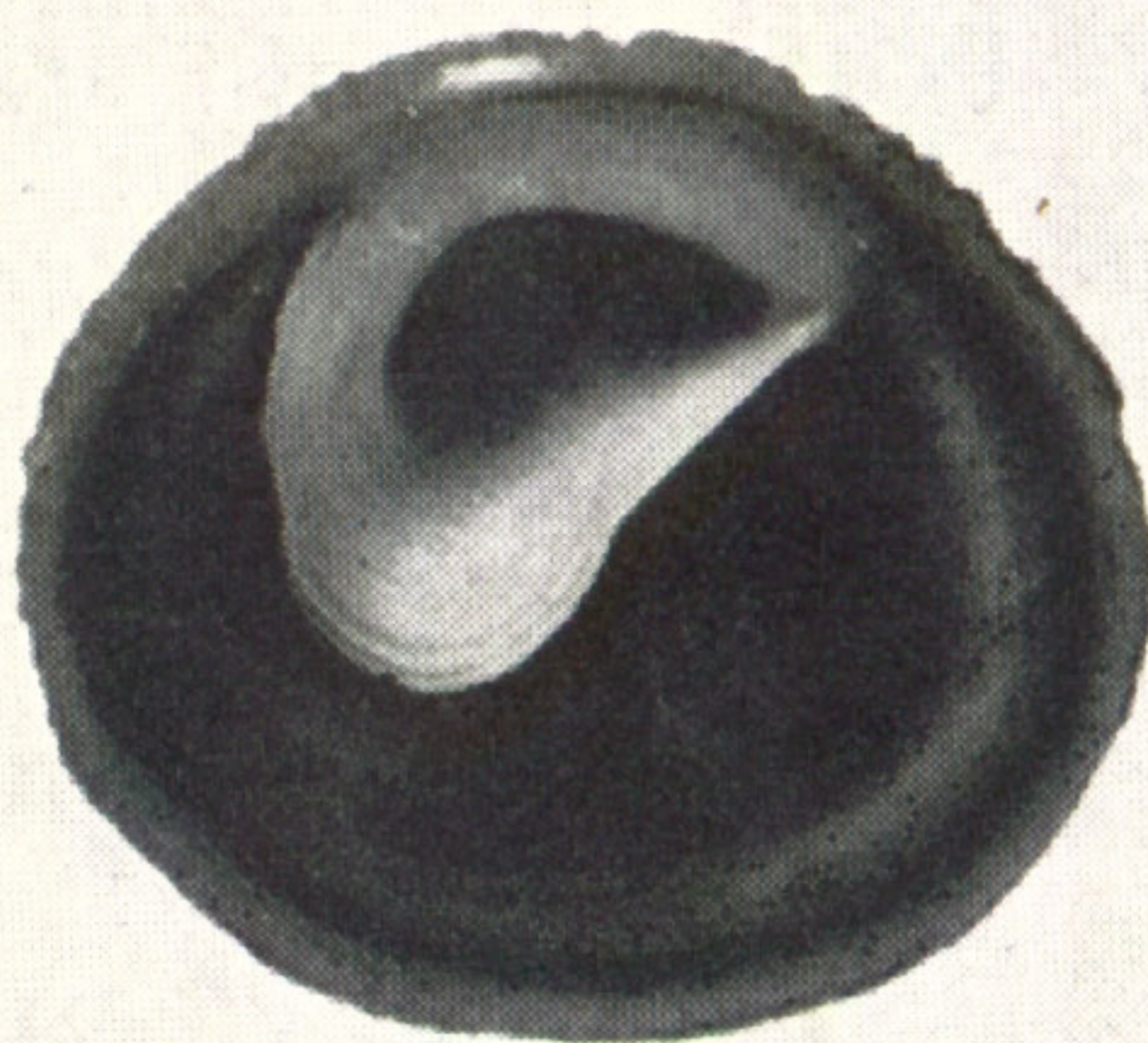
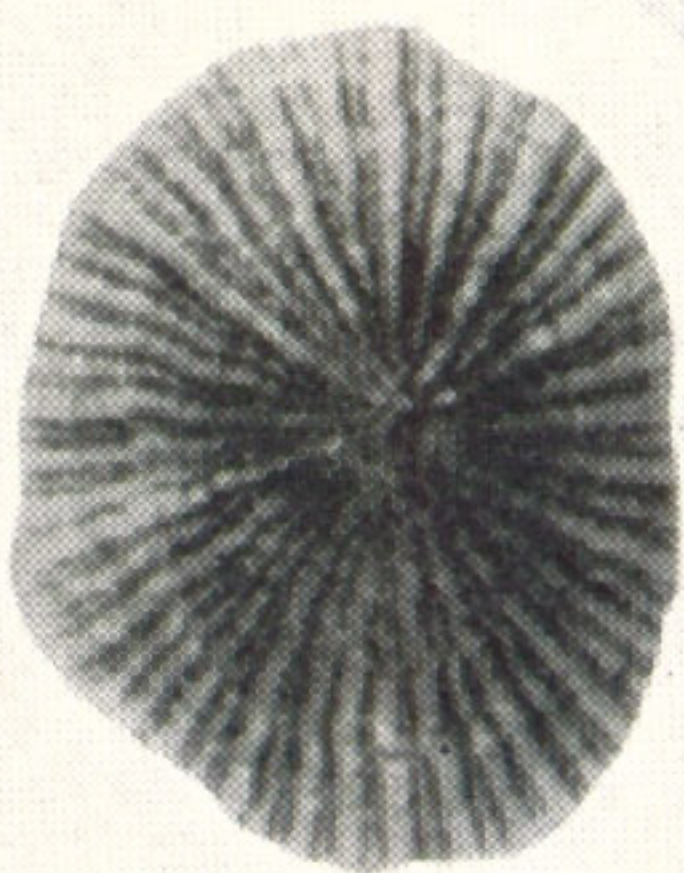
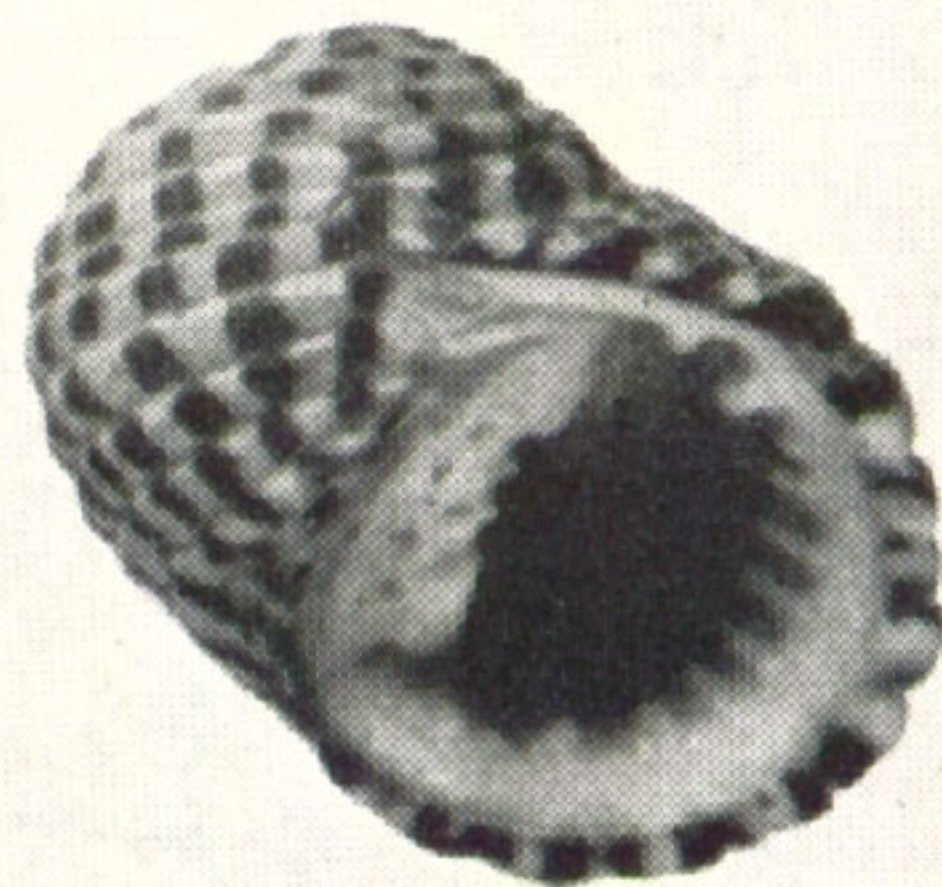
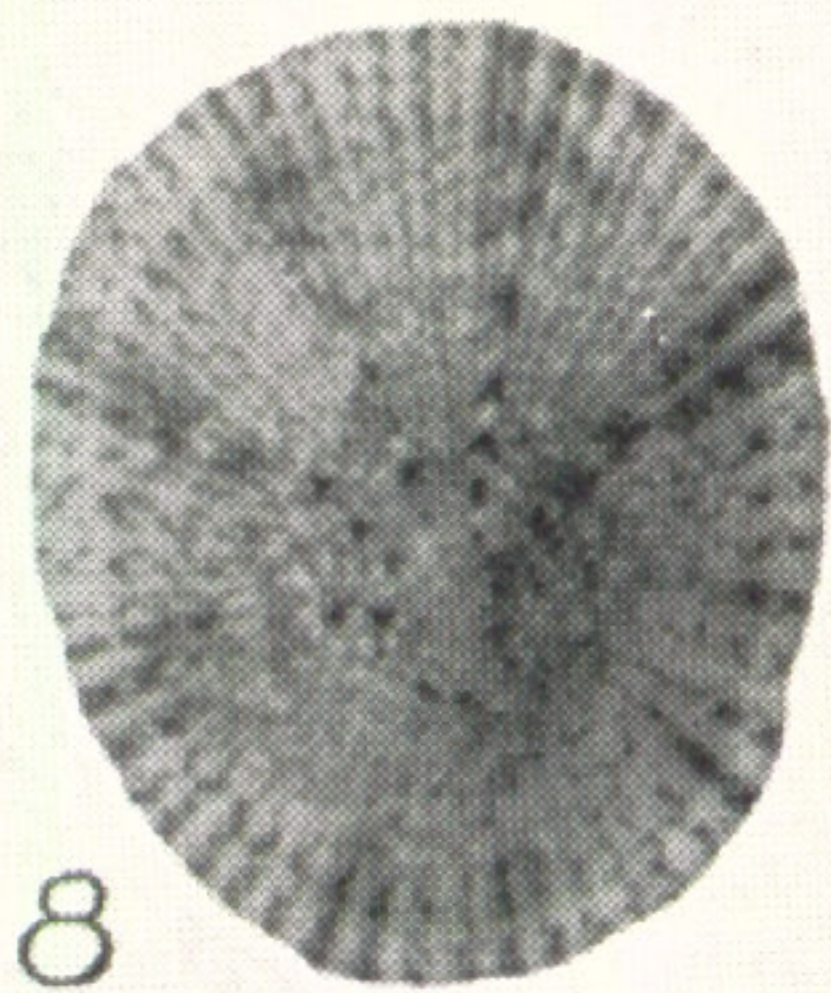
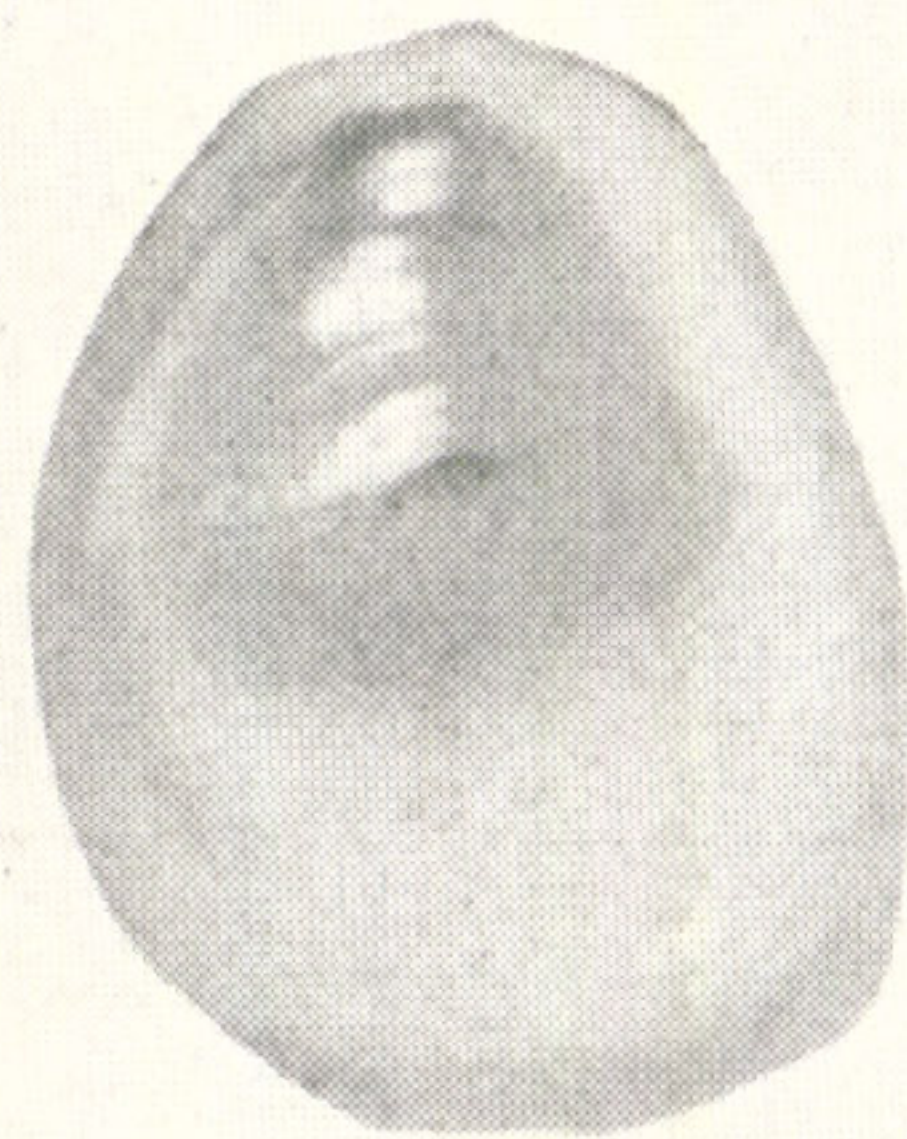
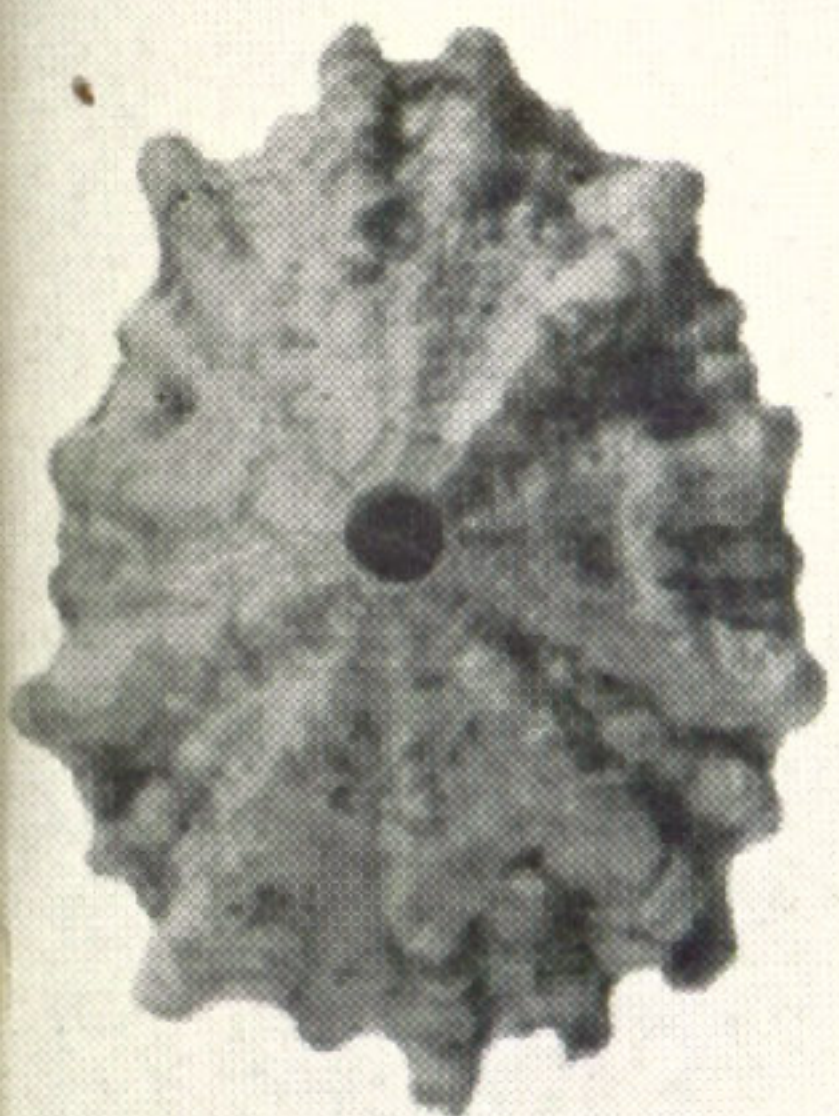
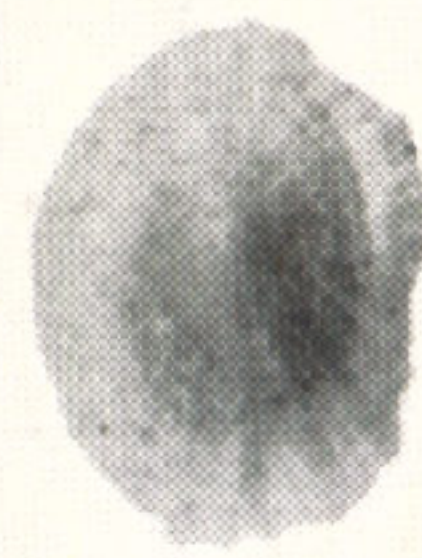
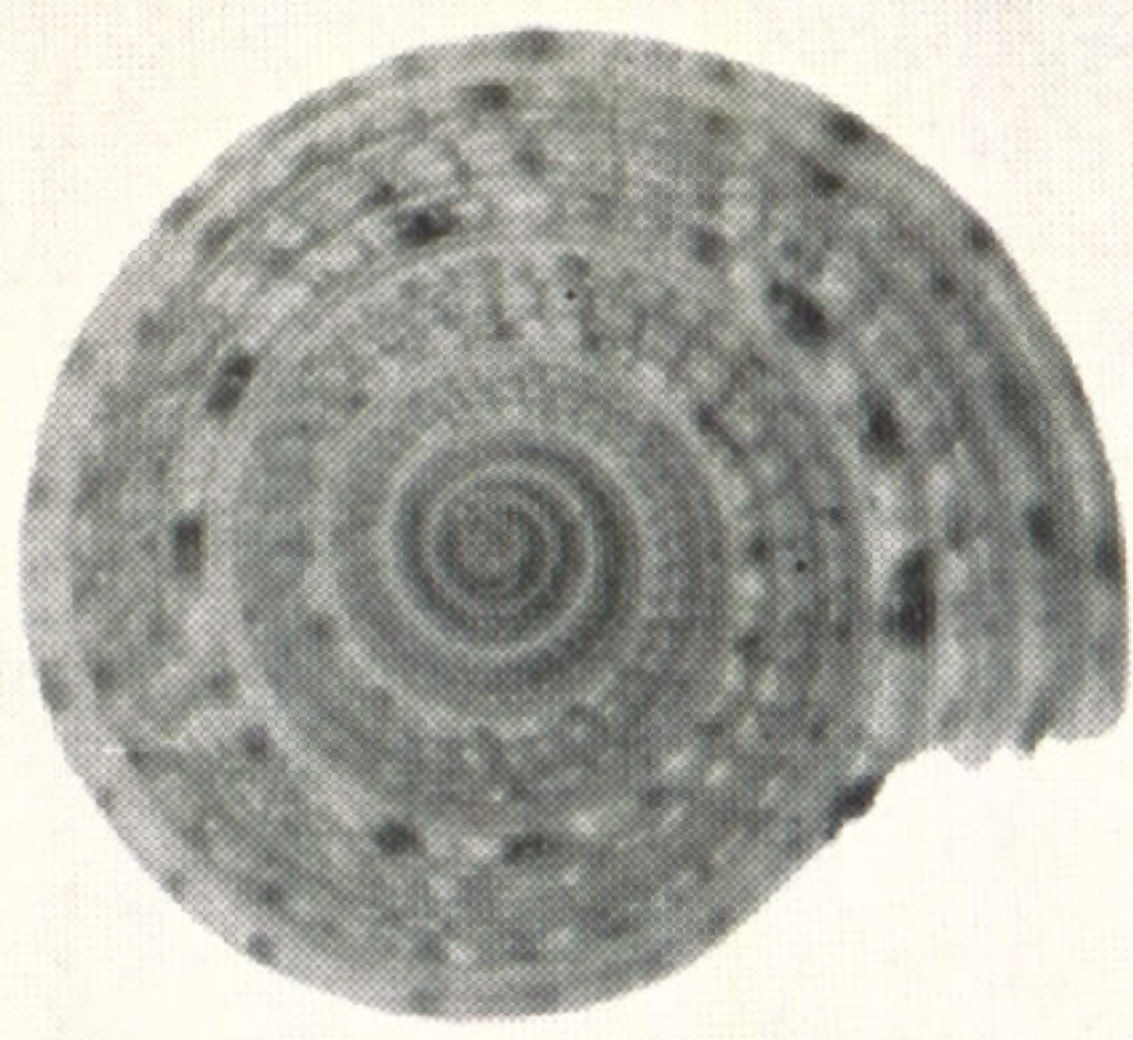
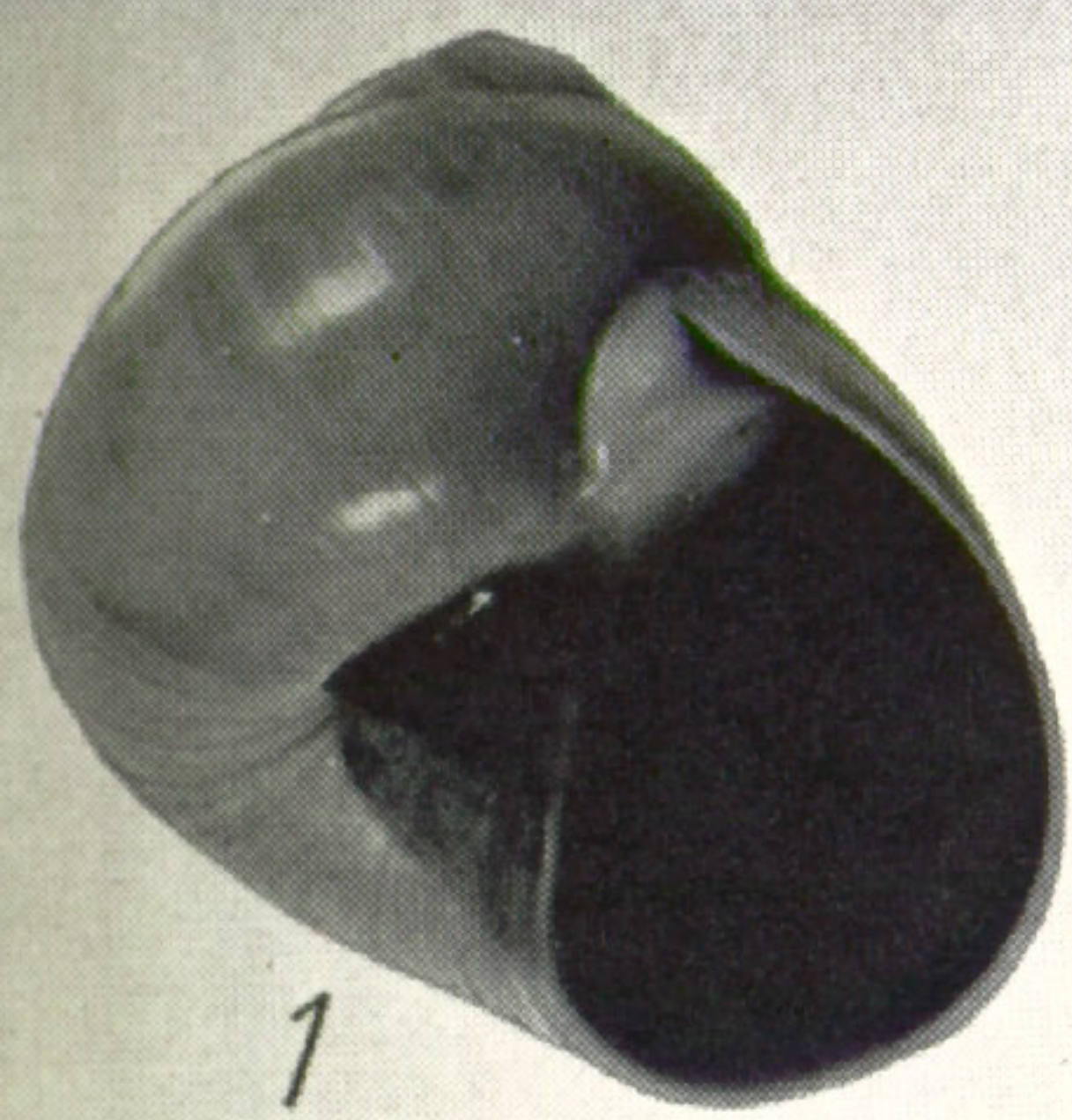
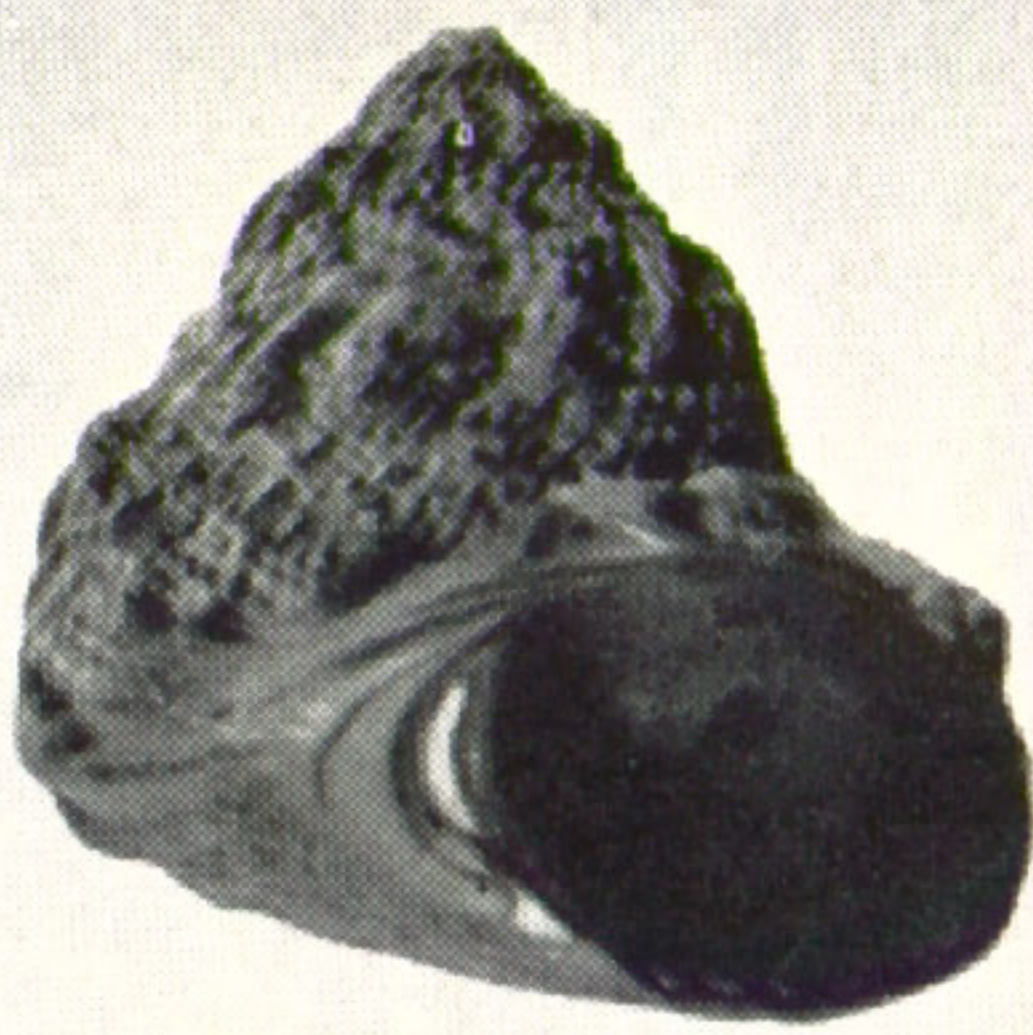


PLATE V ($\frac{1}{2}$ natural size)

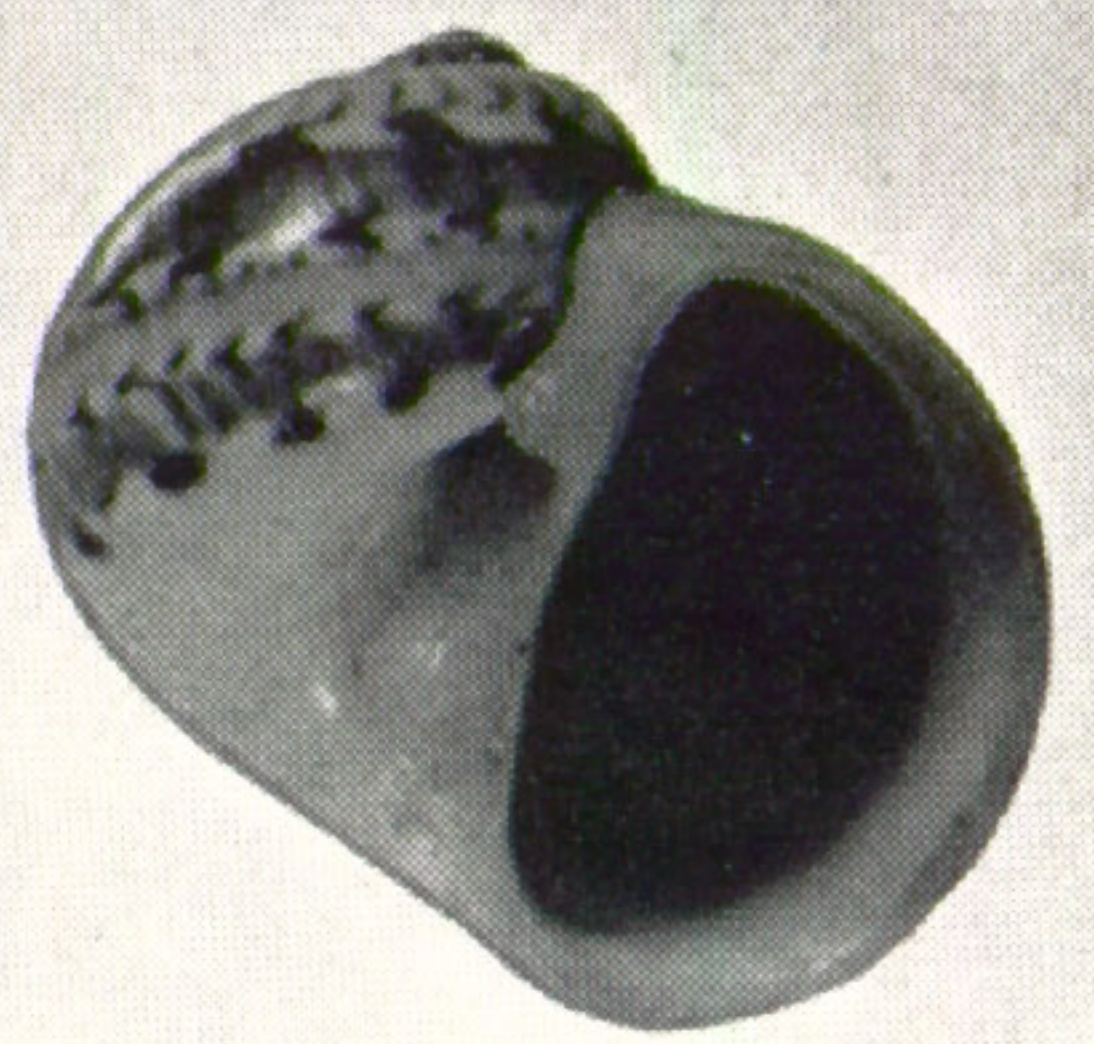
1. The Duplicid Moon Shell (*Polinices duplicata*). 62
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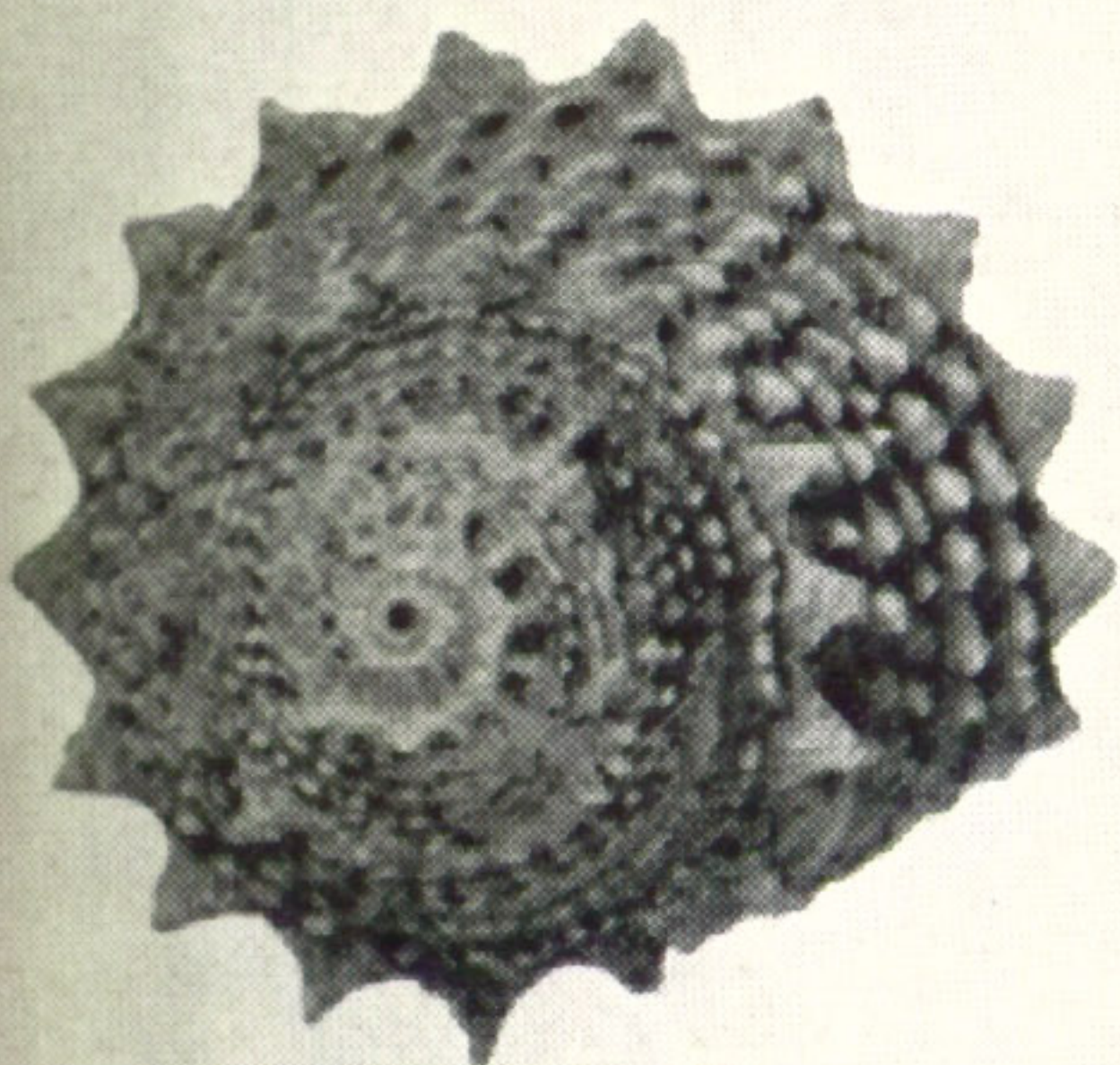
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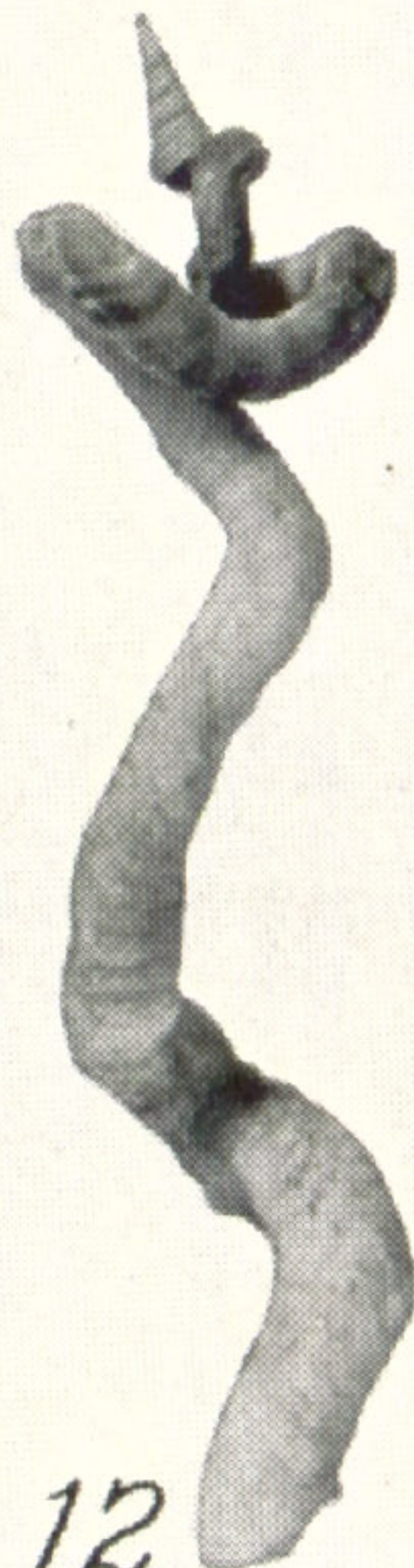
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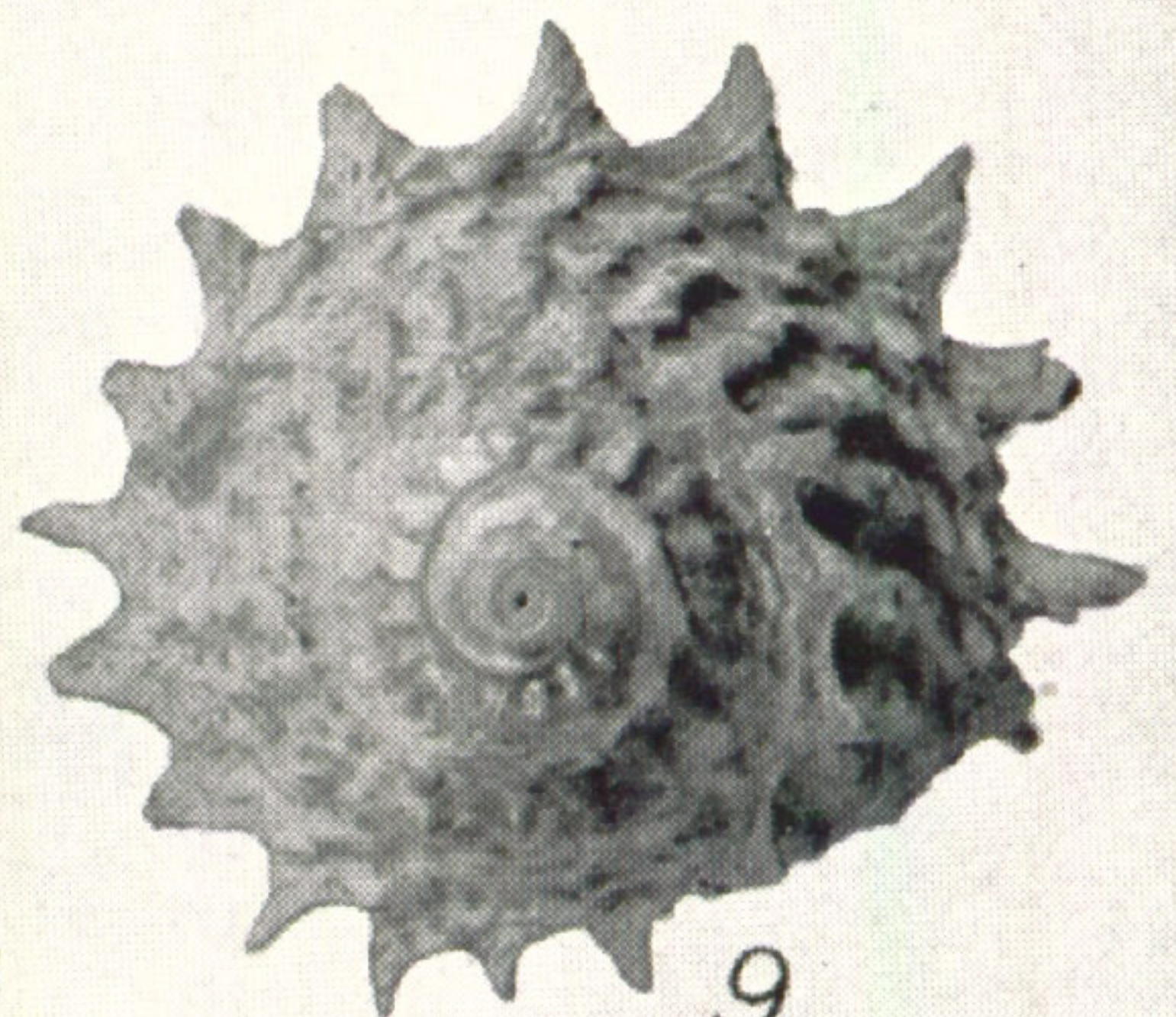
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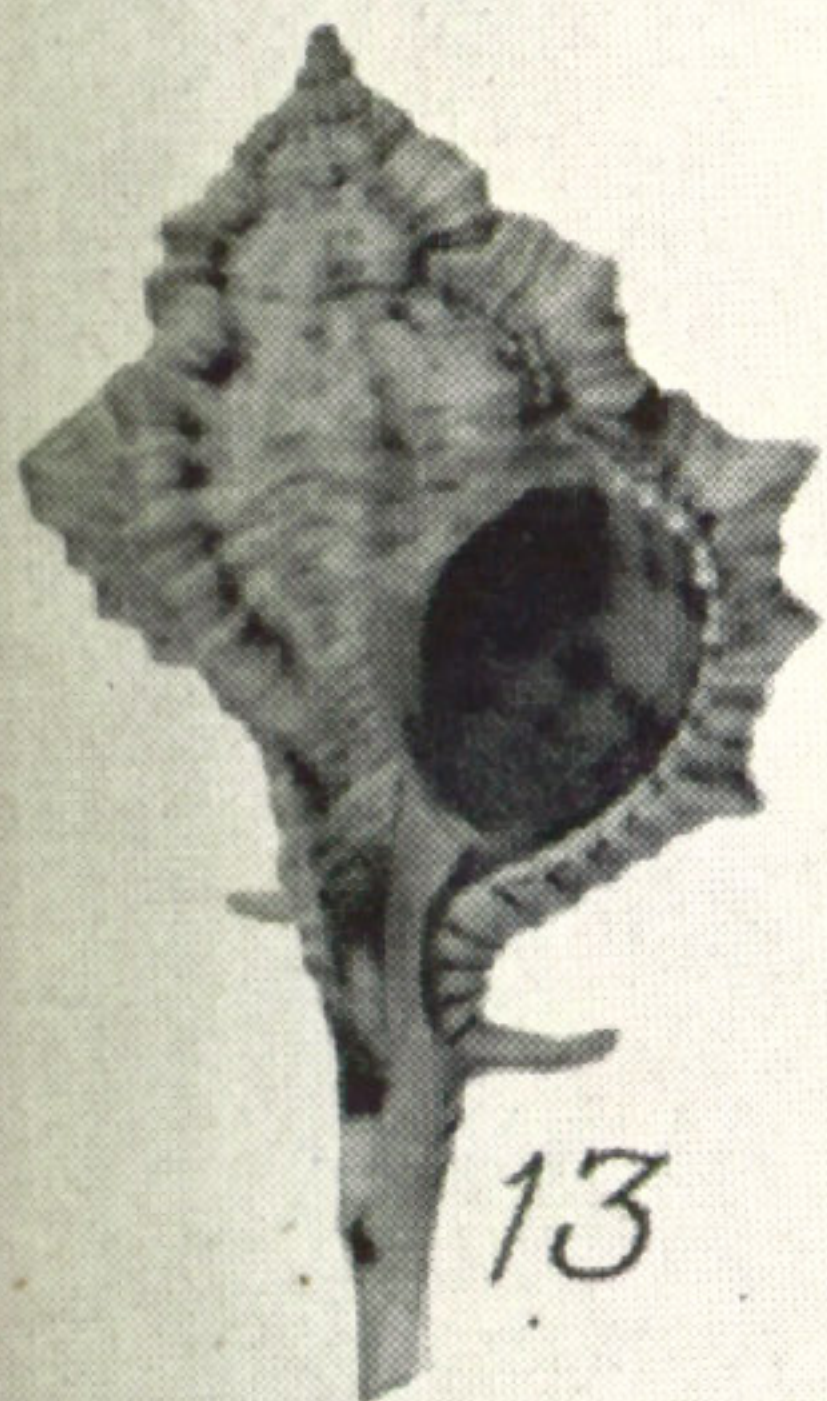
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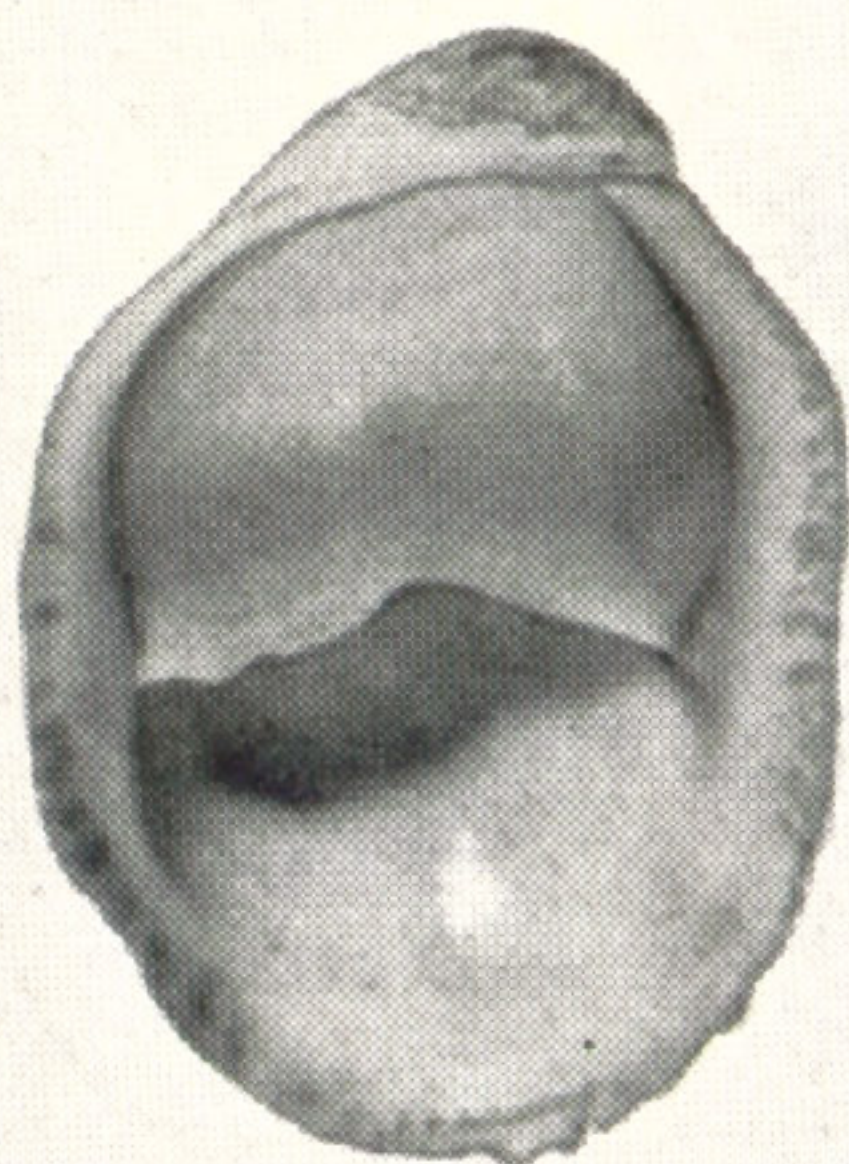
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PLATE VI (3 times natural size)

1. Short Pyramid Shell (*Turbonilla curta*). 62
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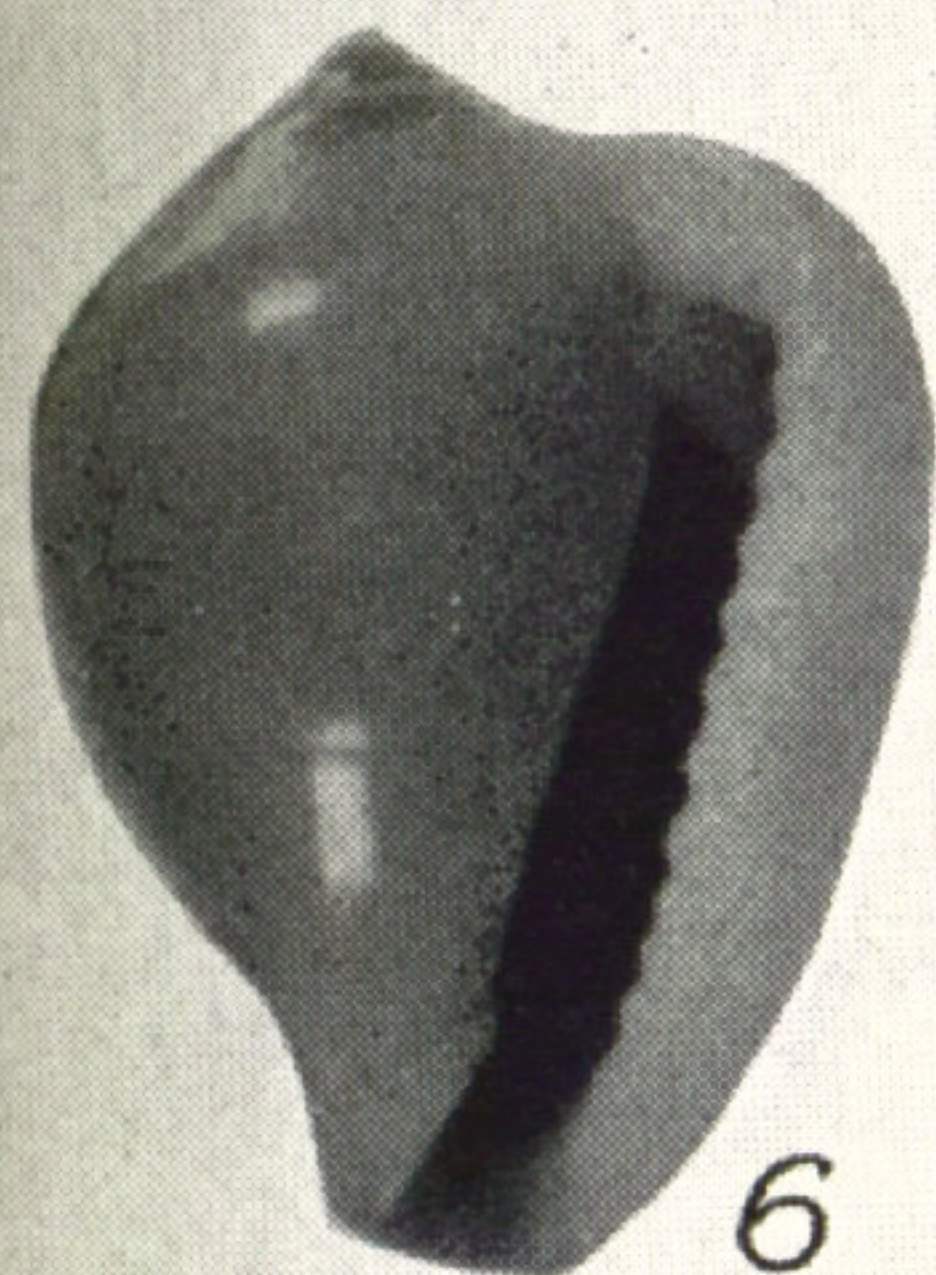
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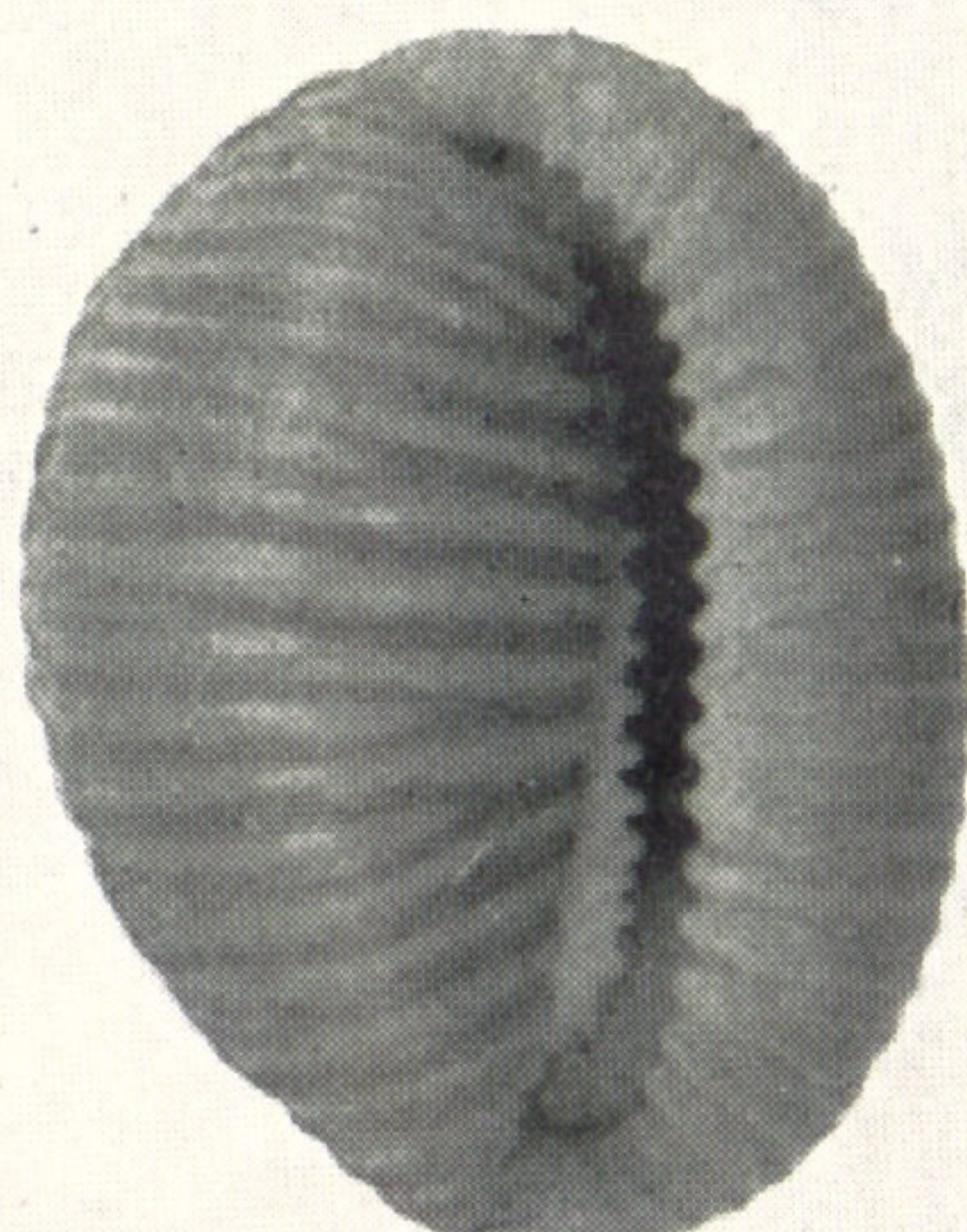
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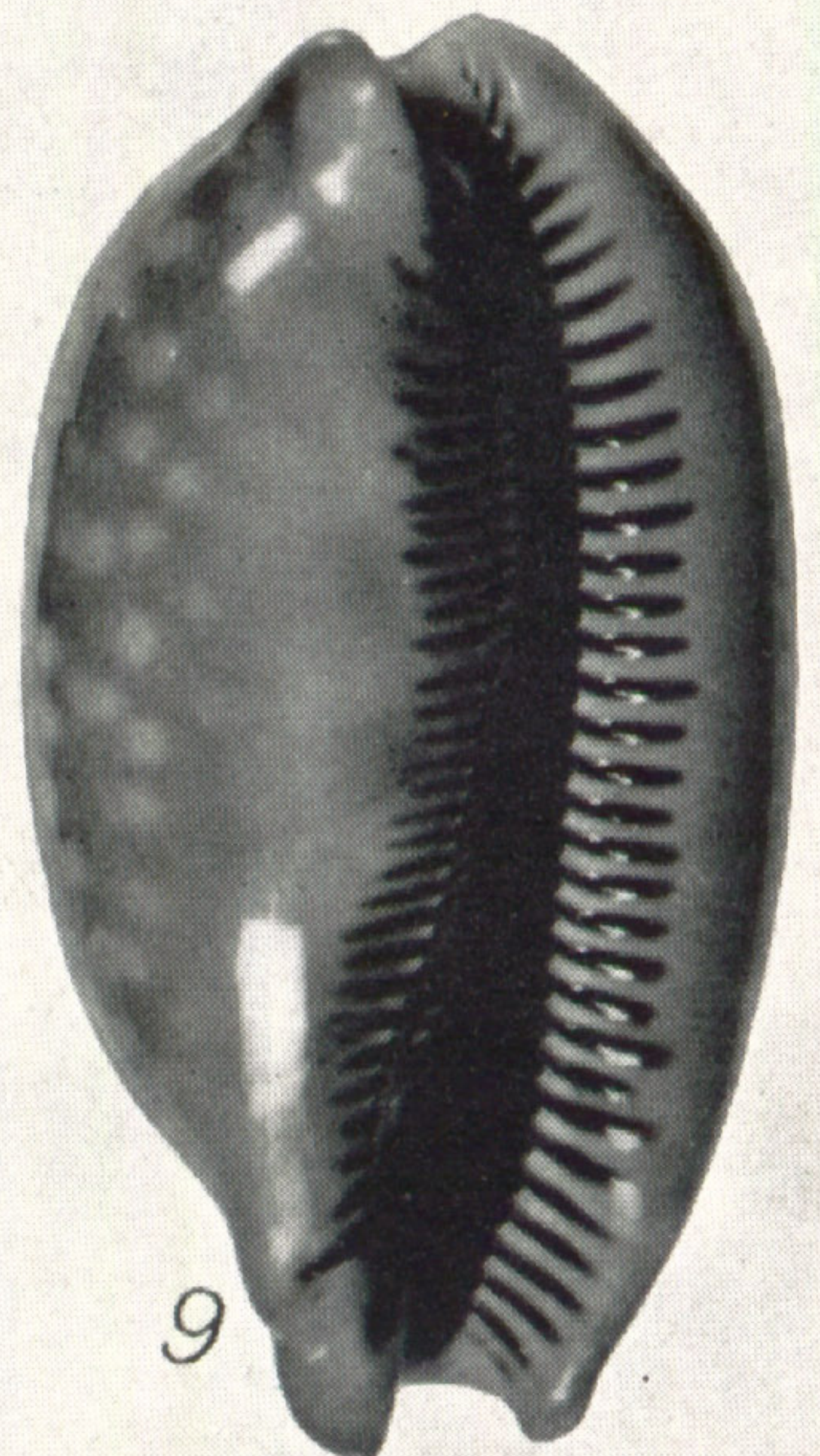
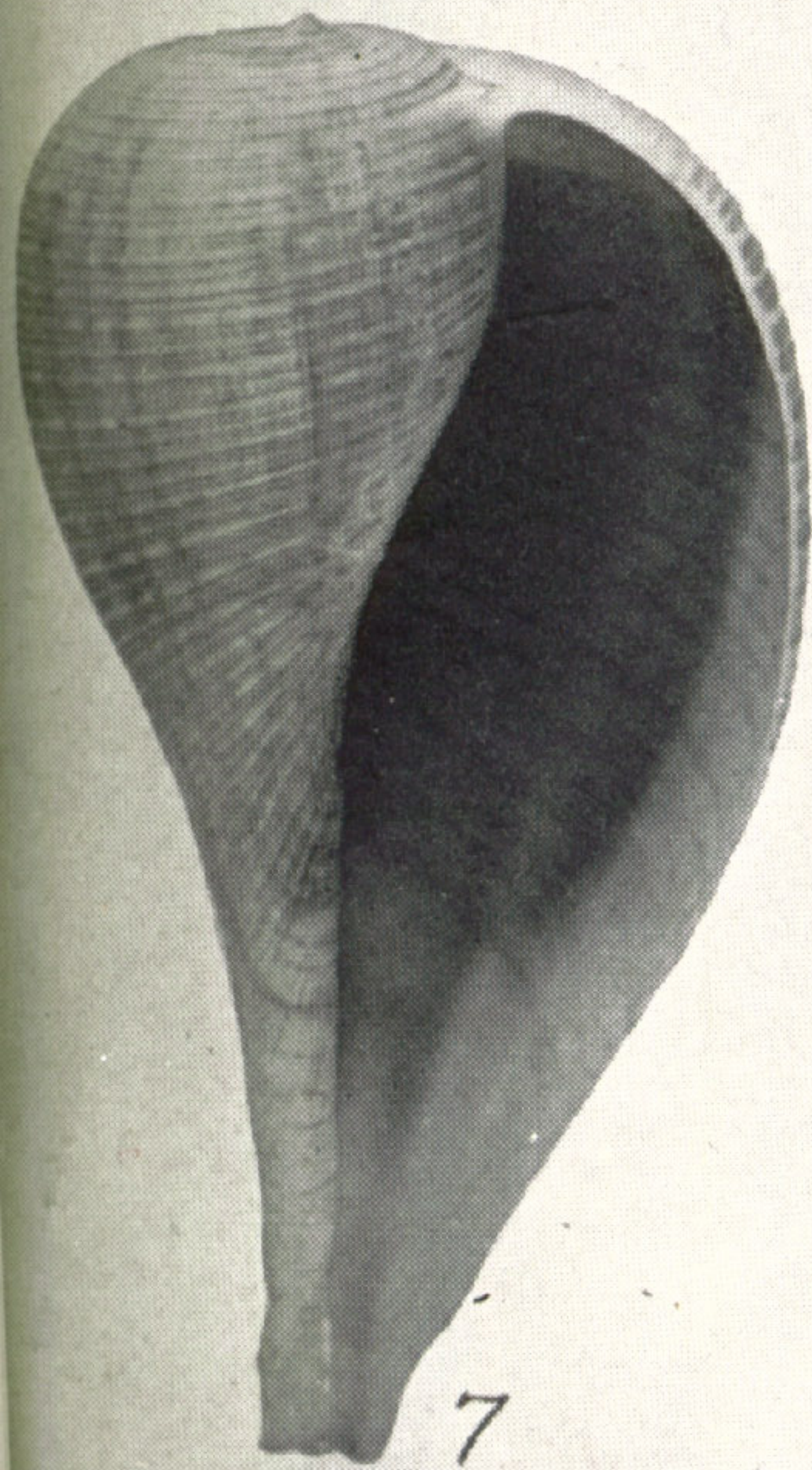
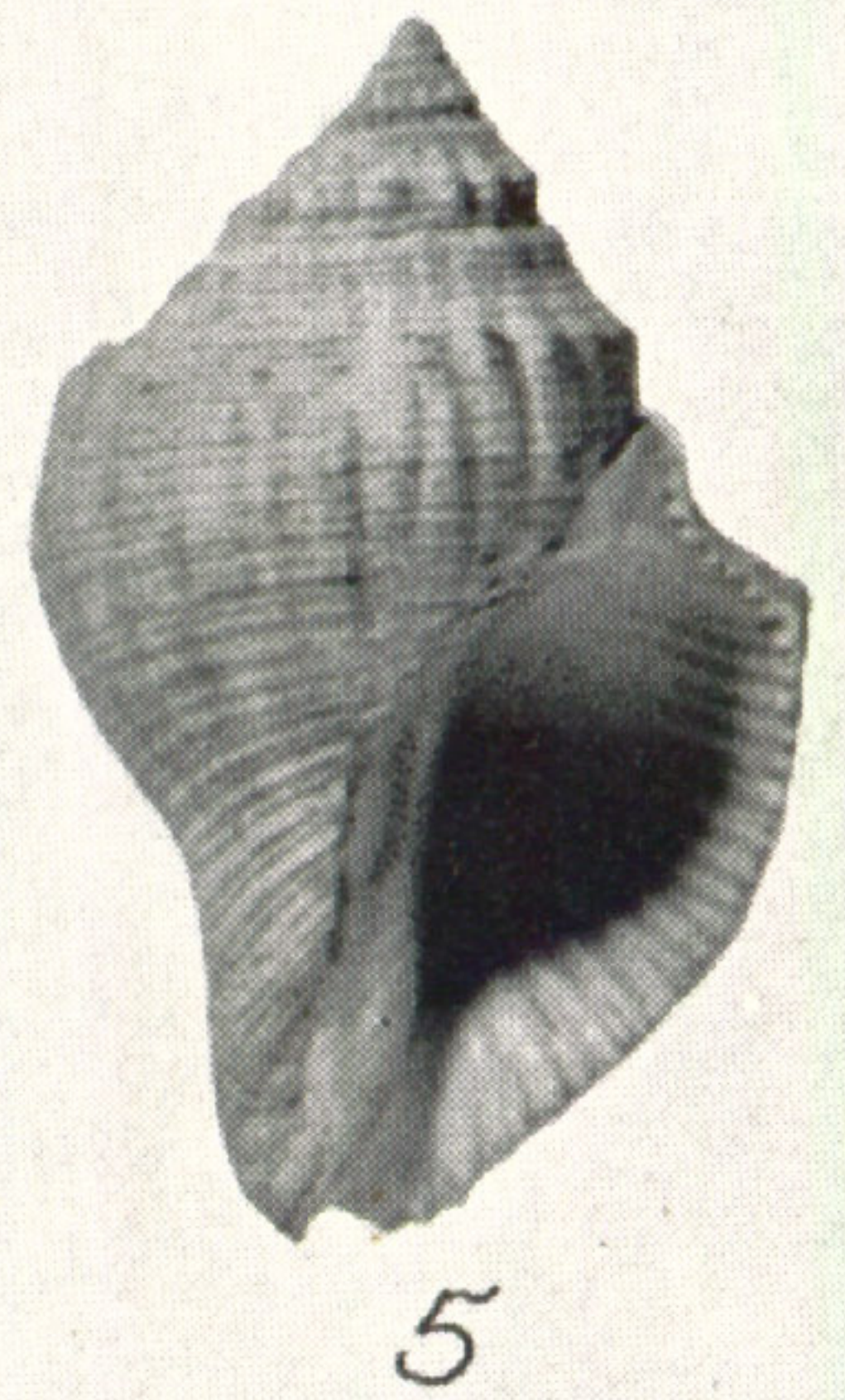
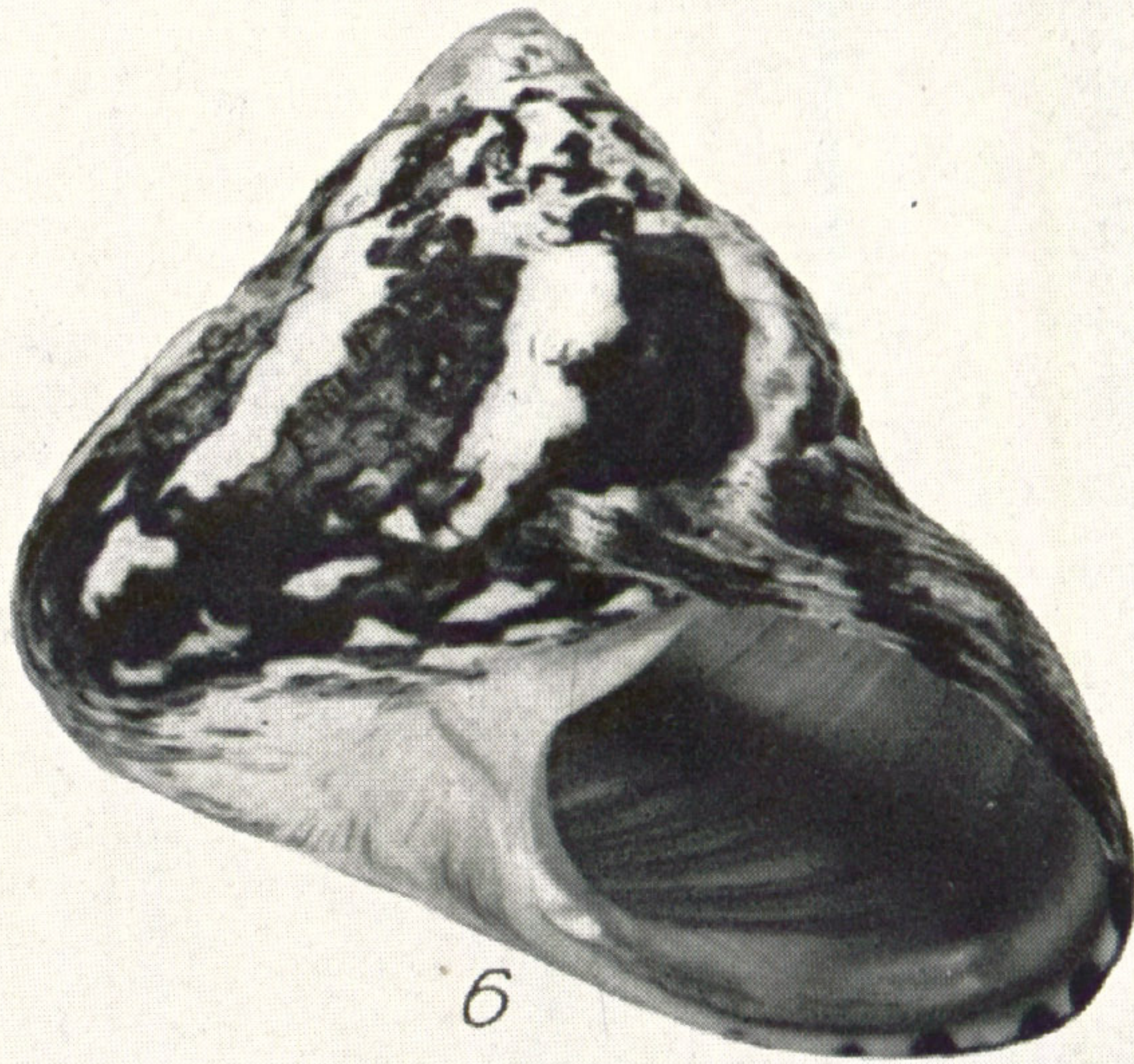
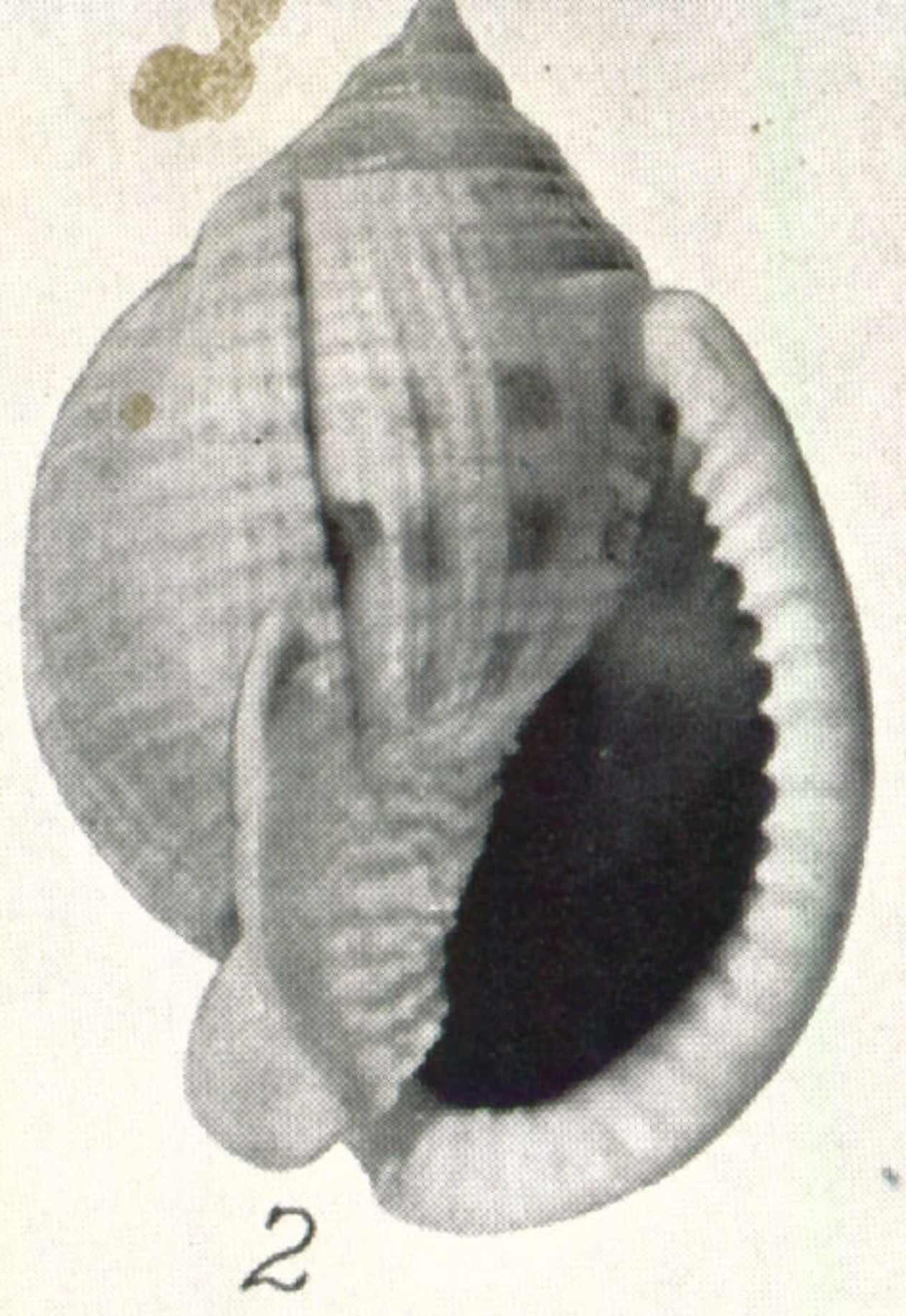
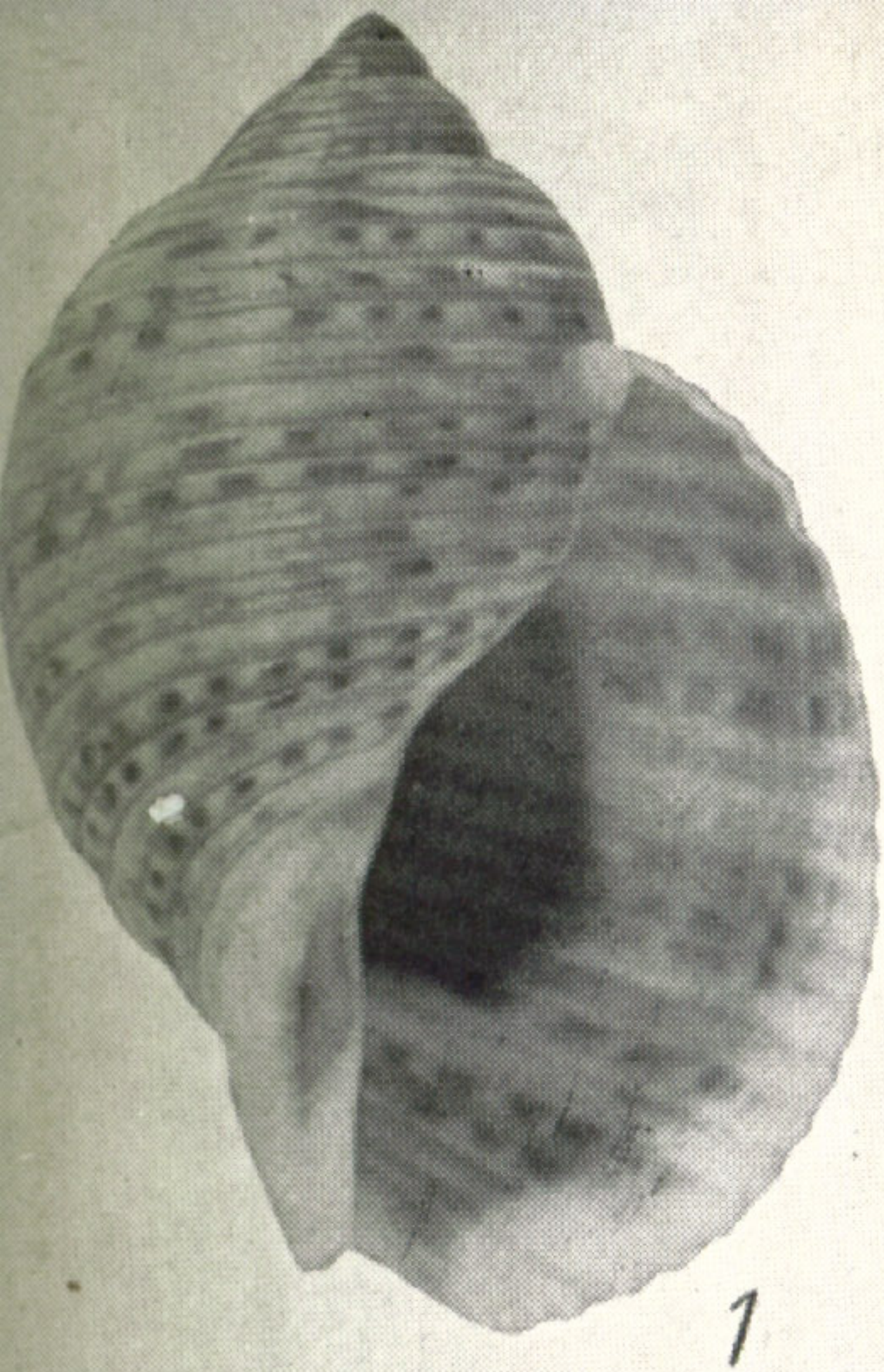


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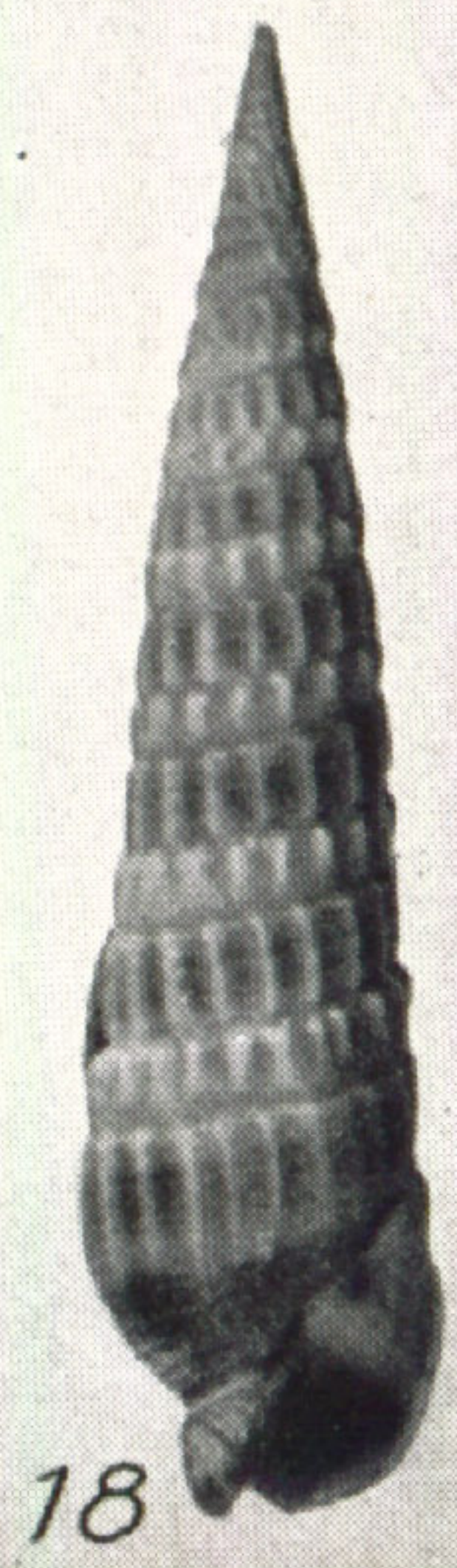
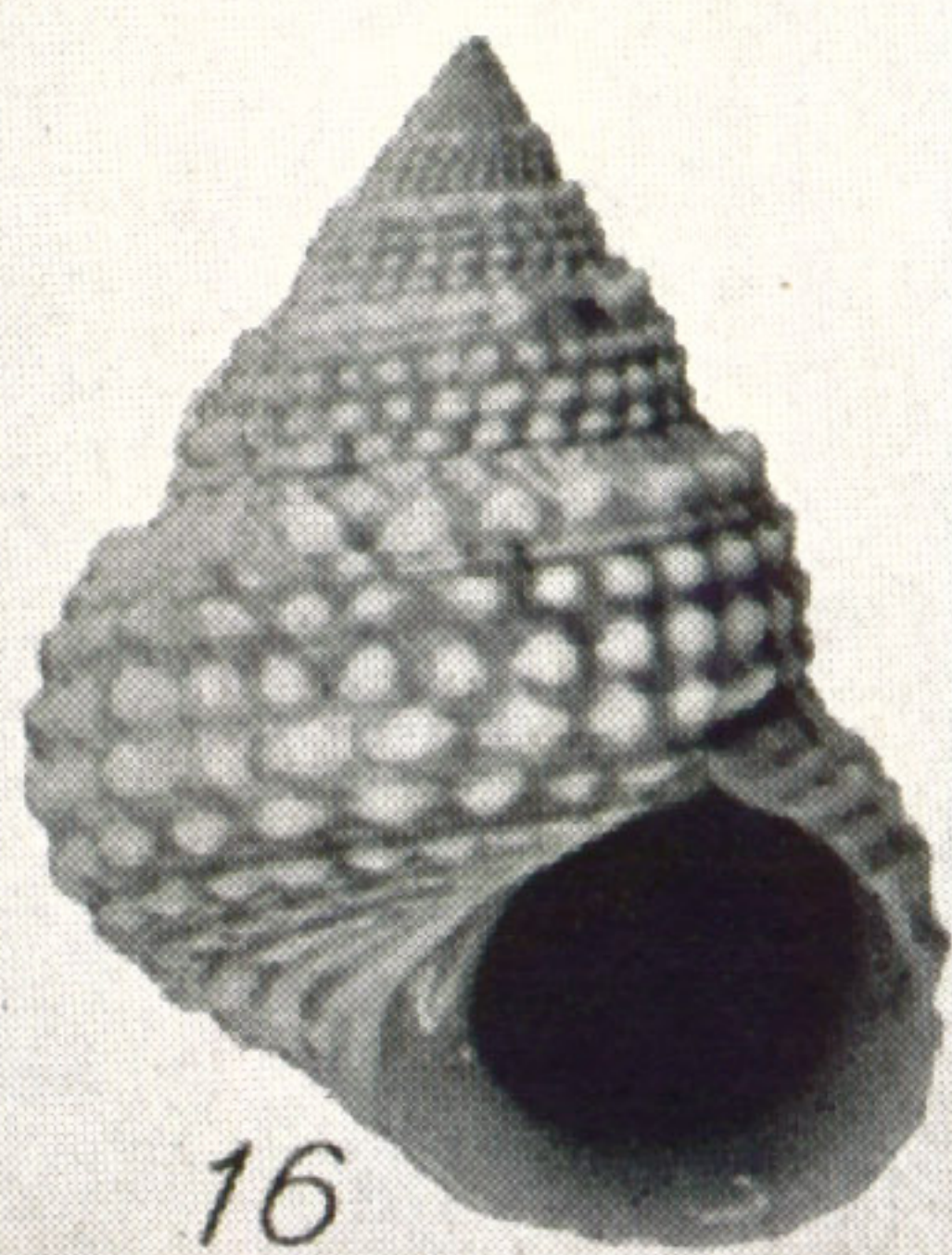
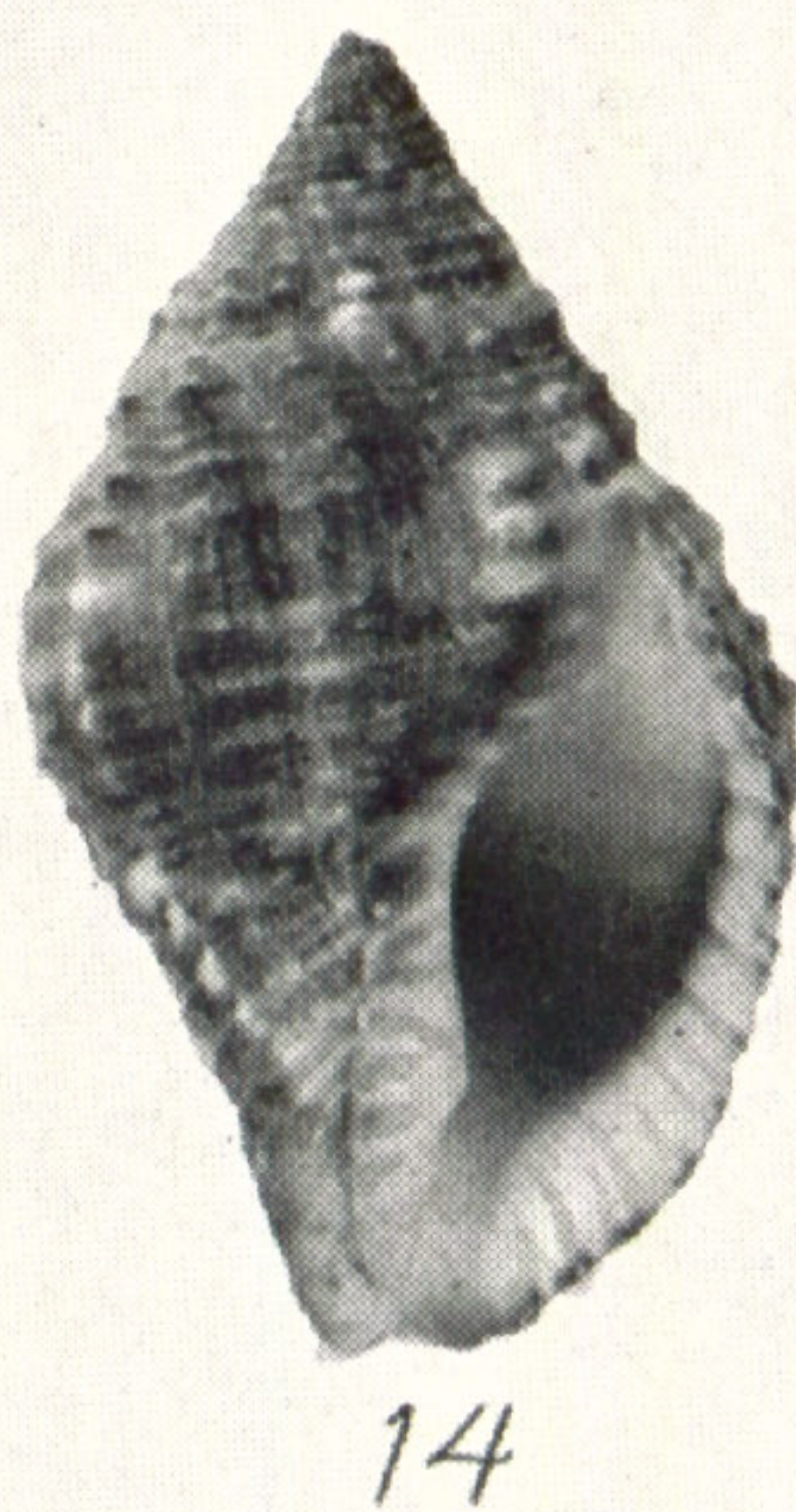
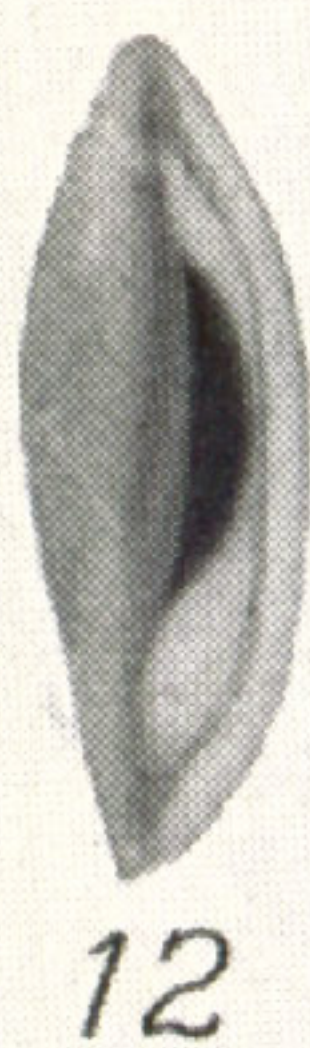
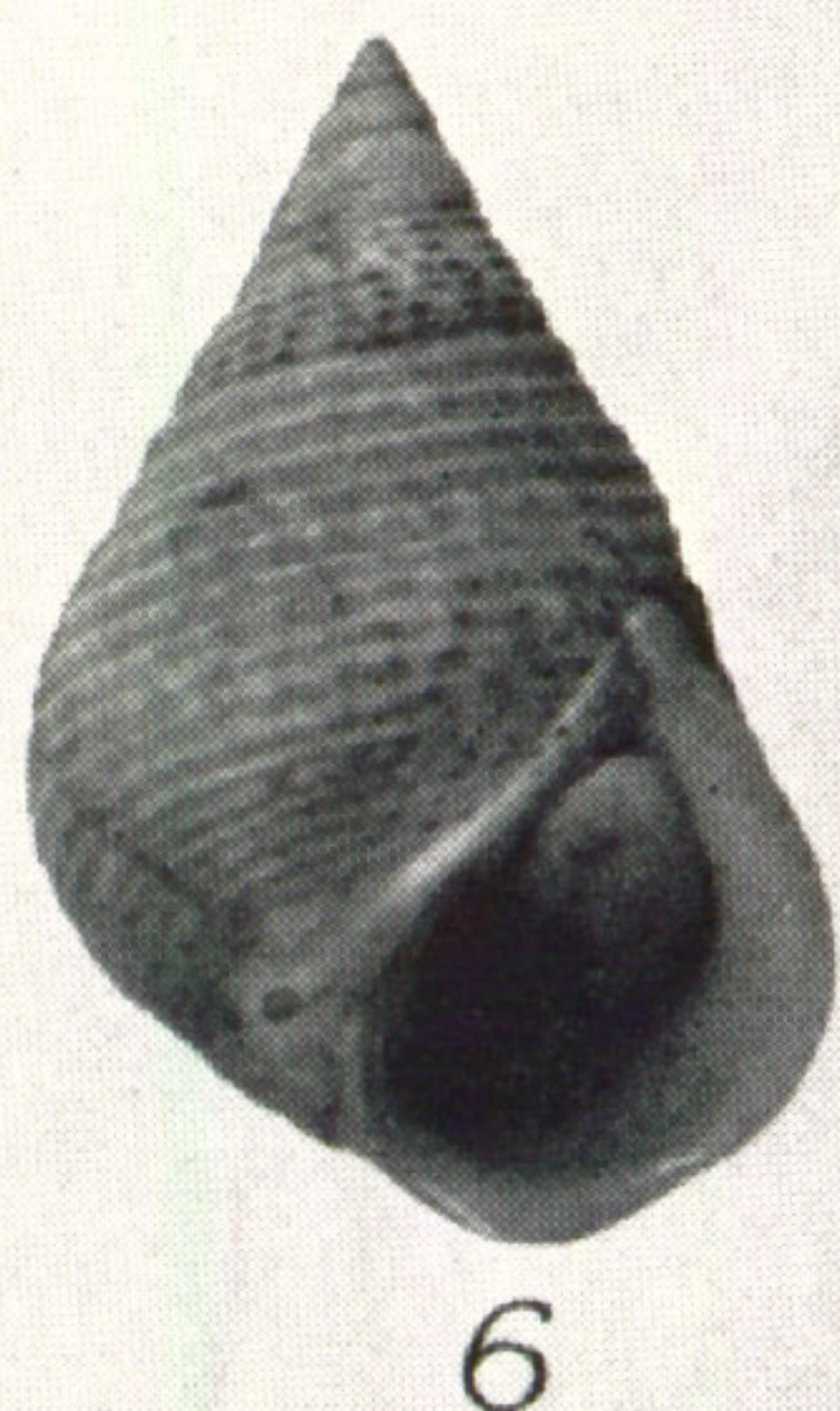
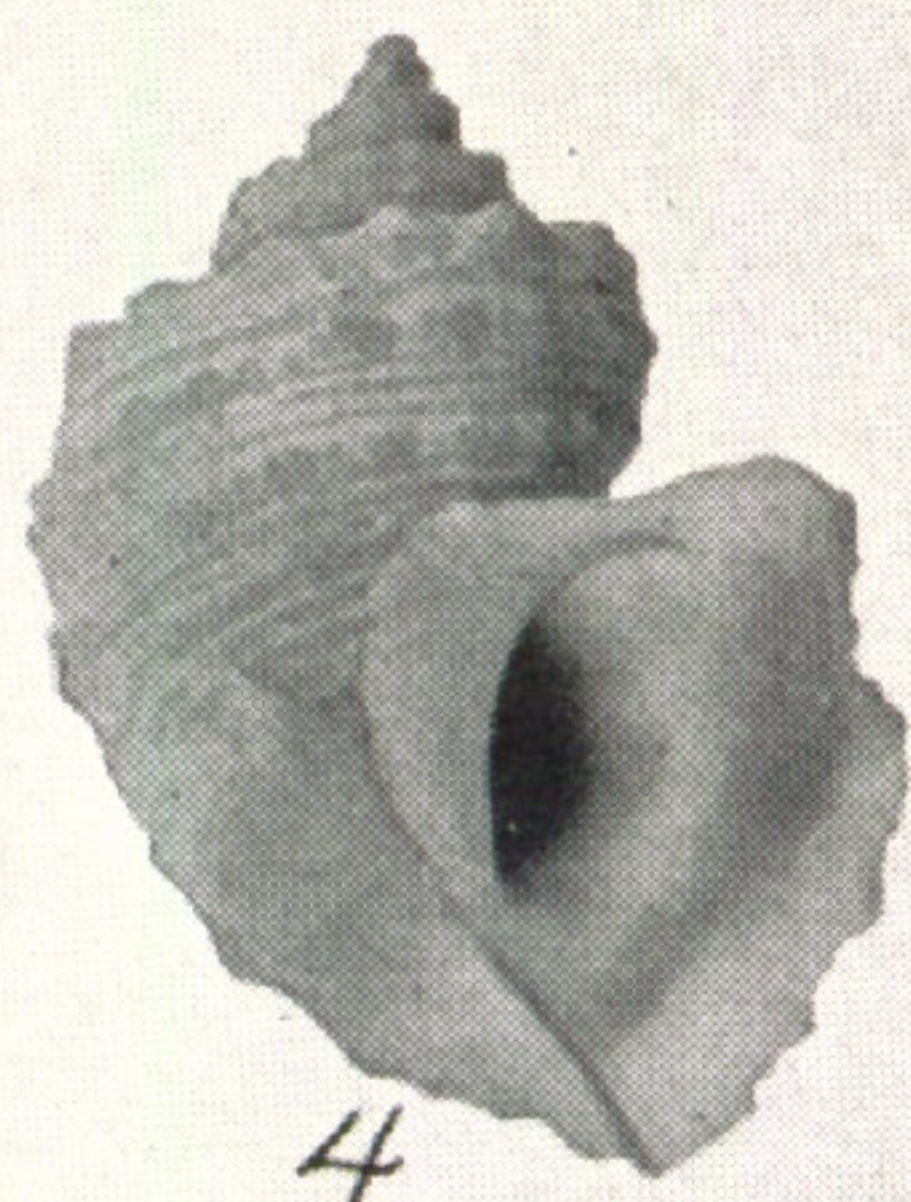
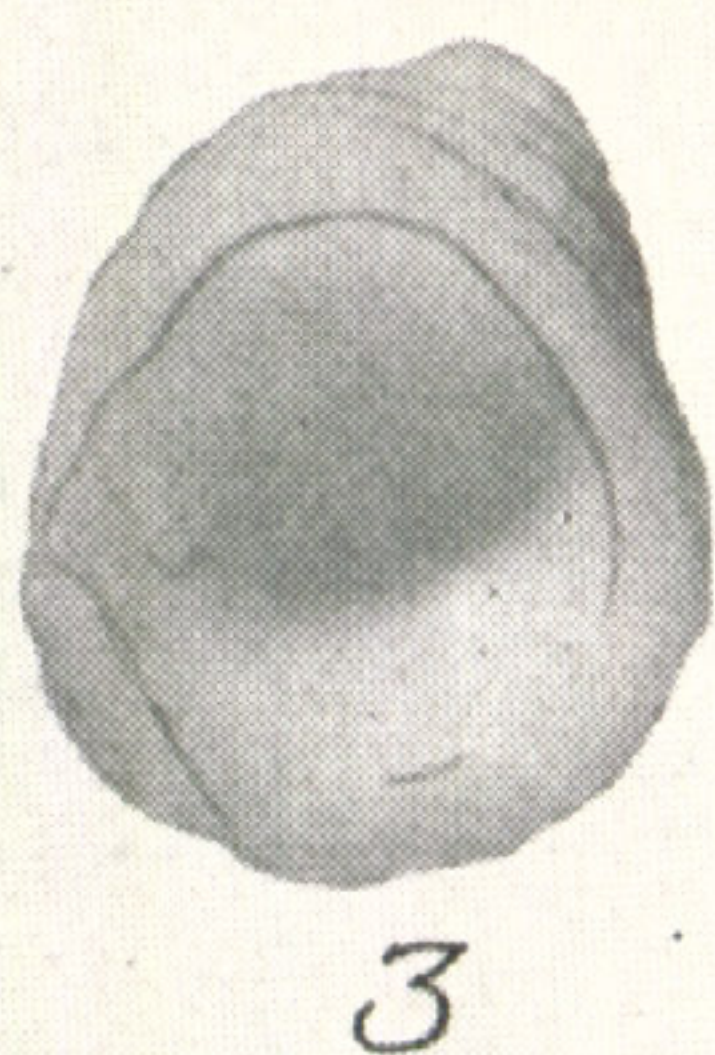


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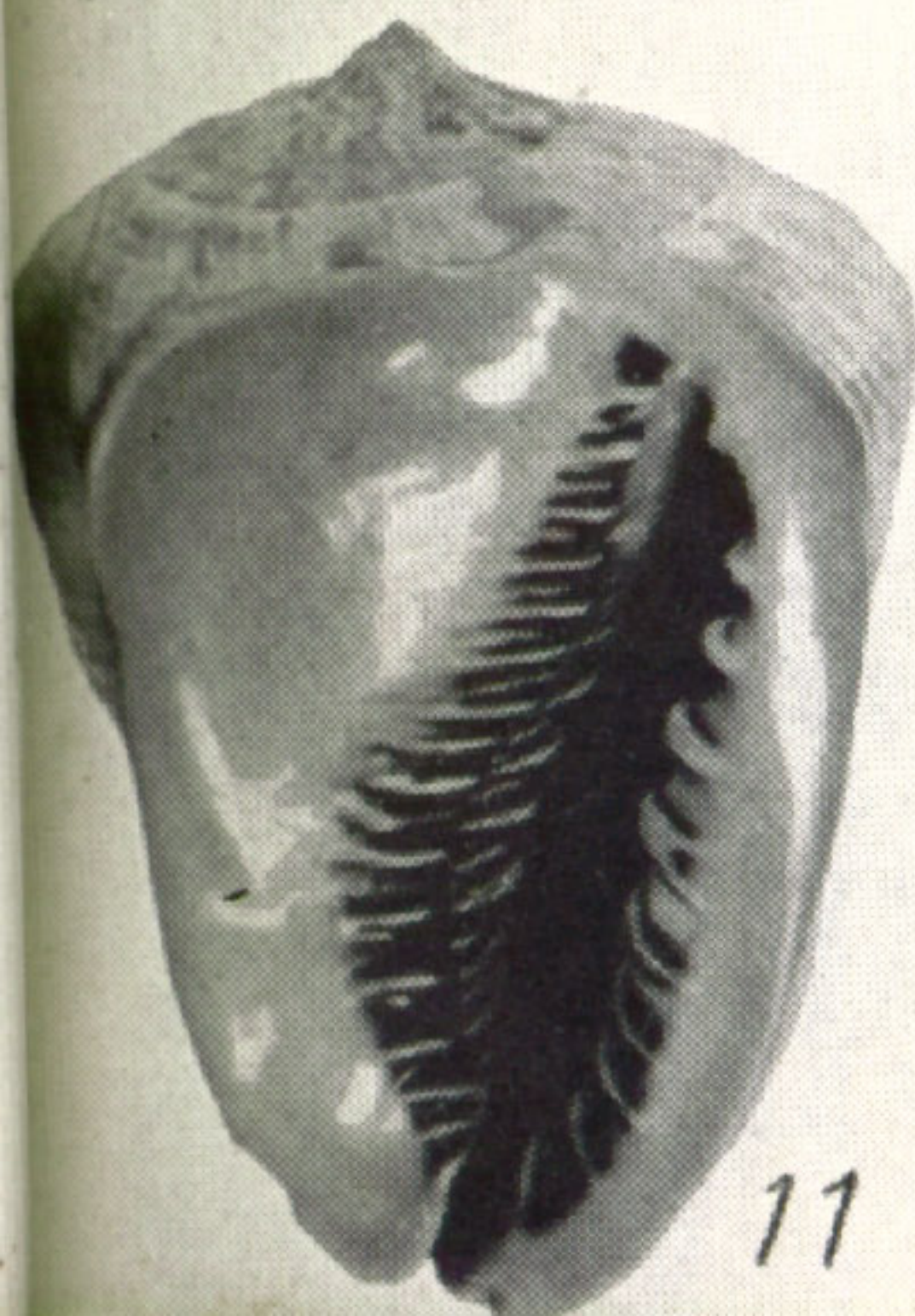
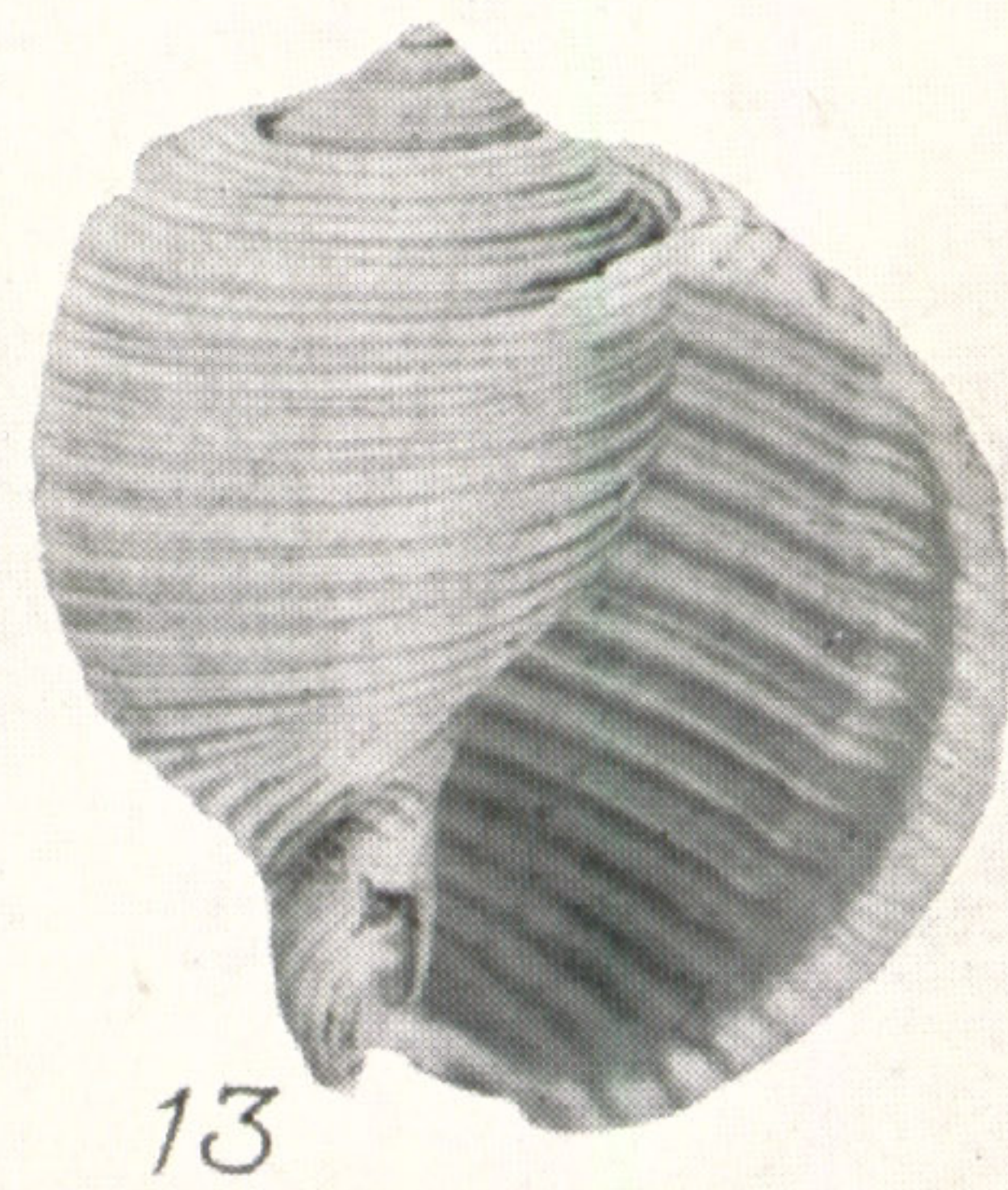
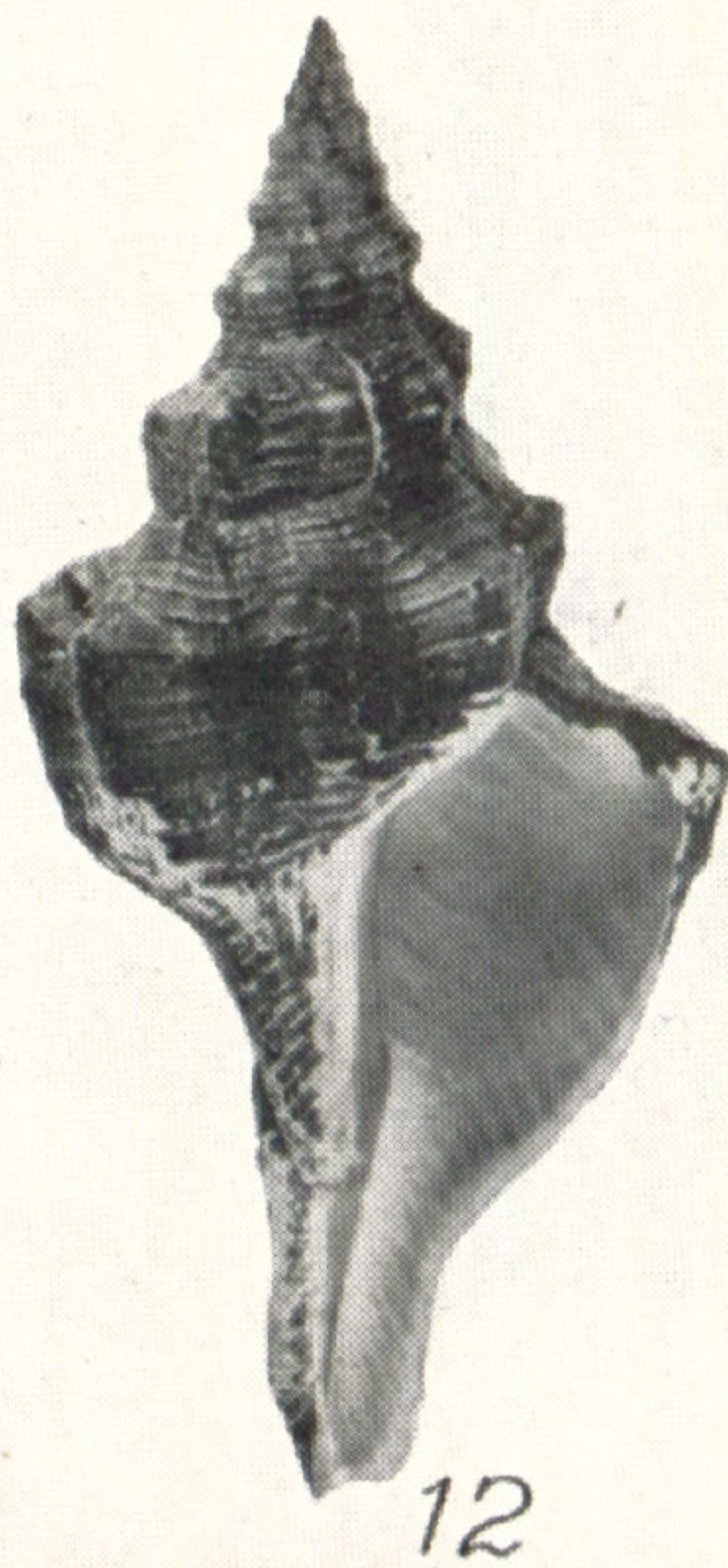
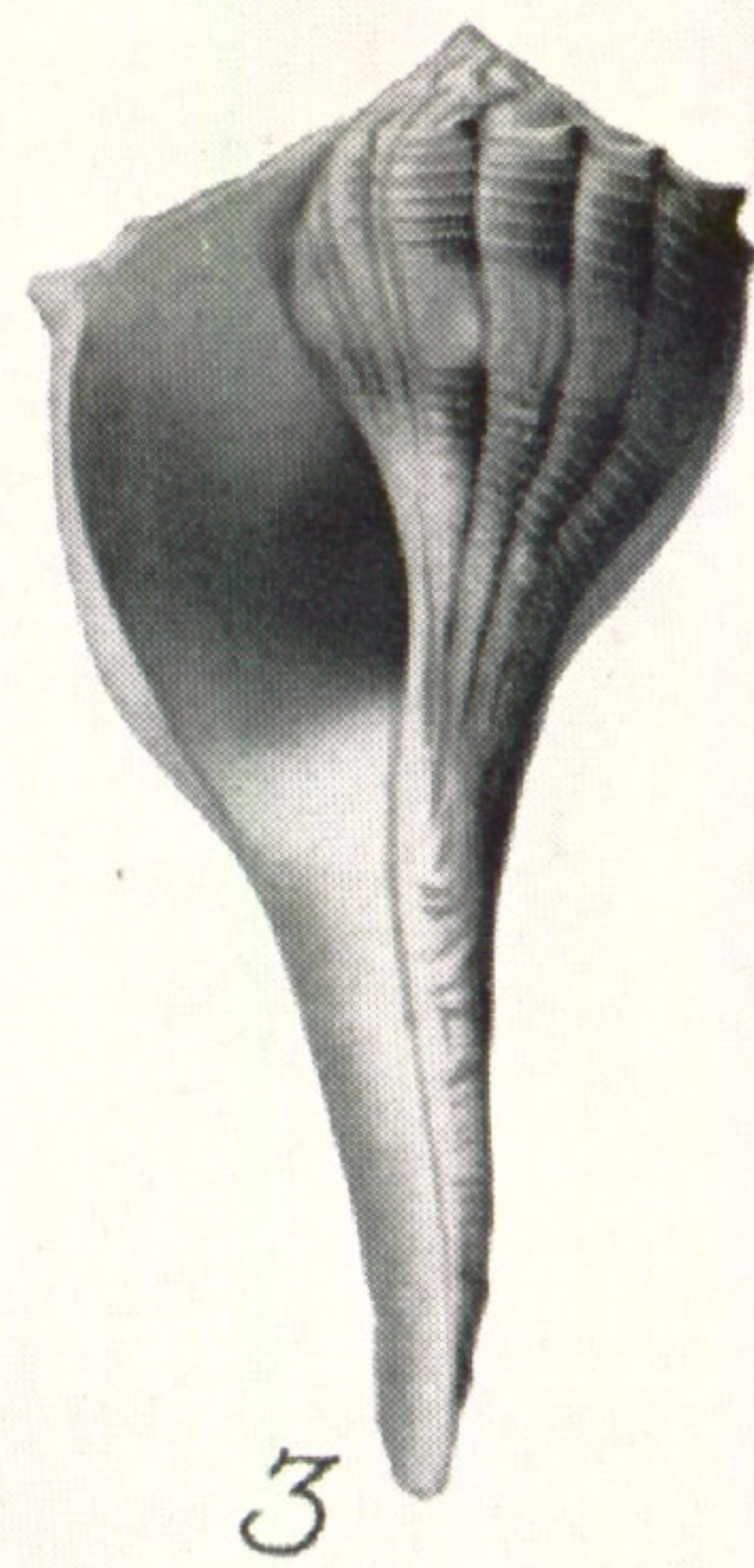
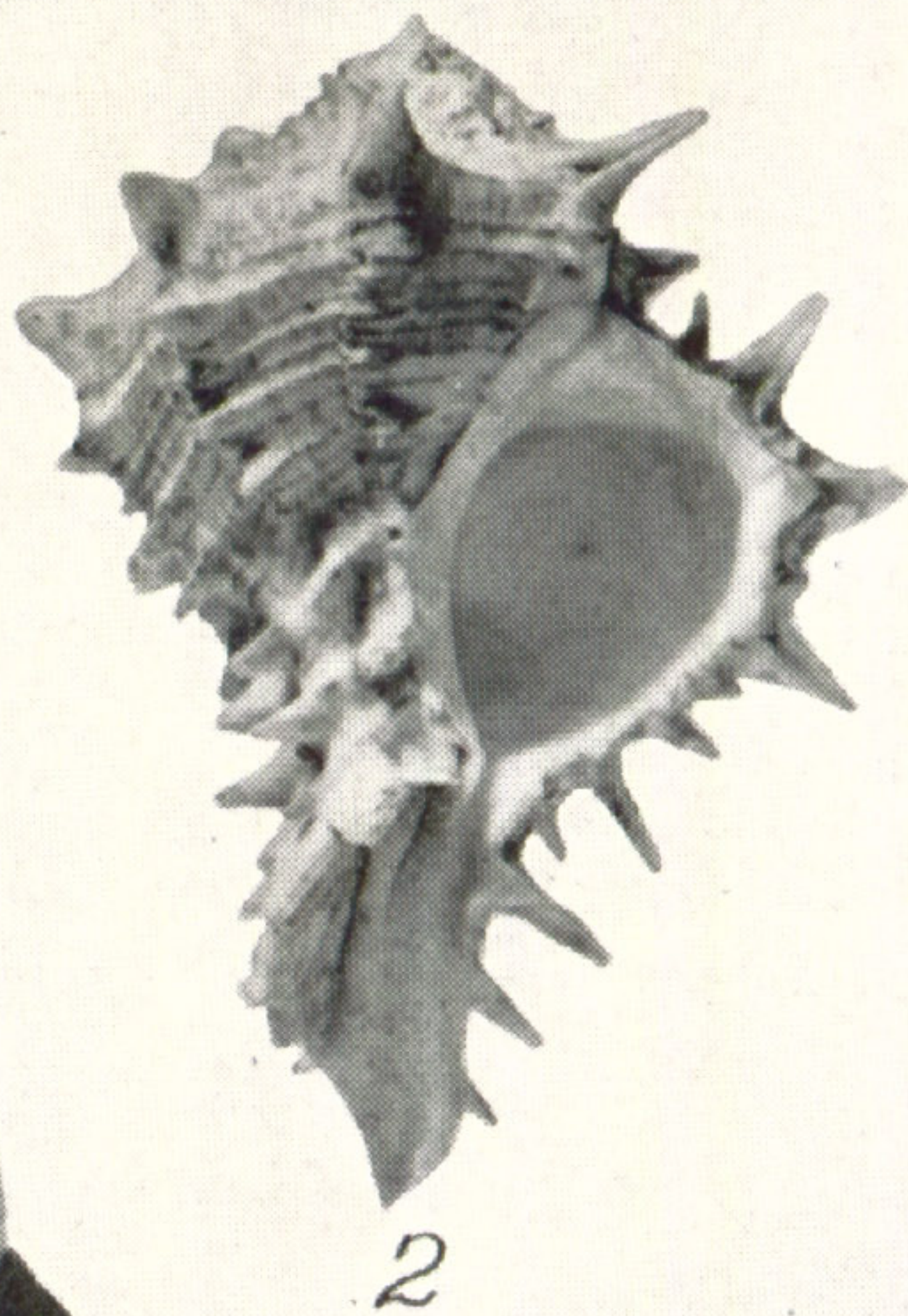
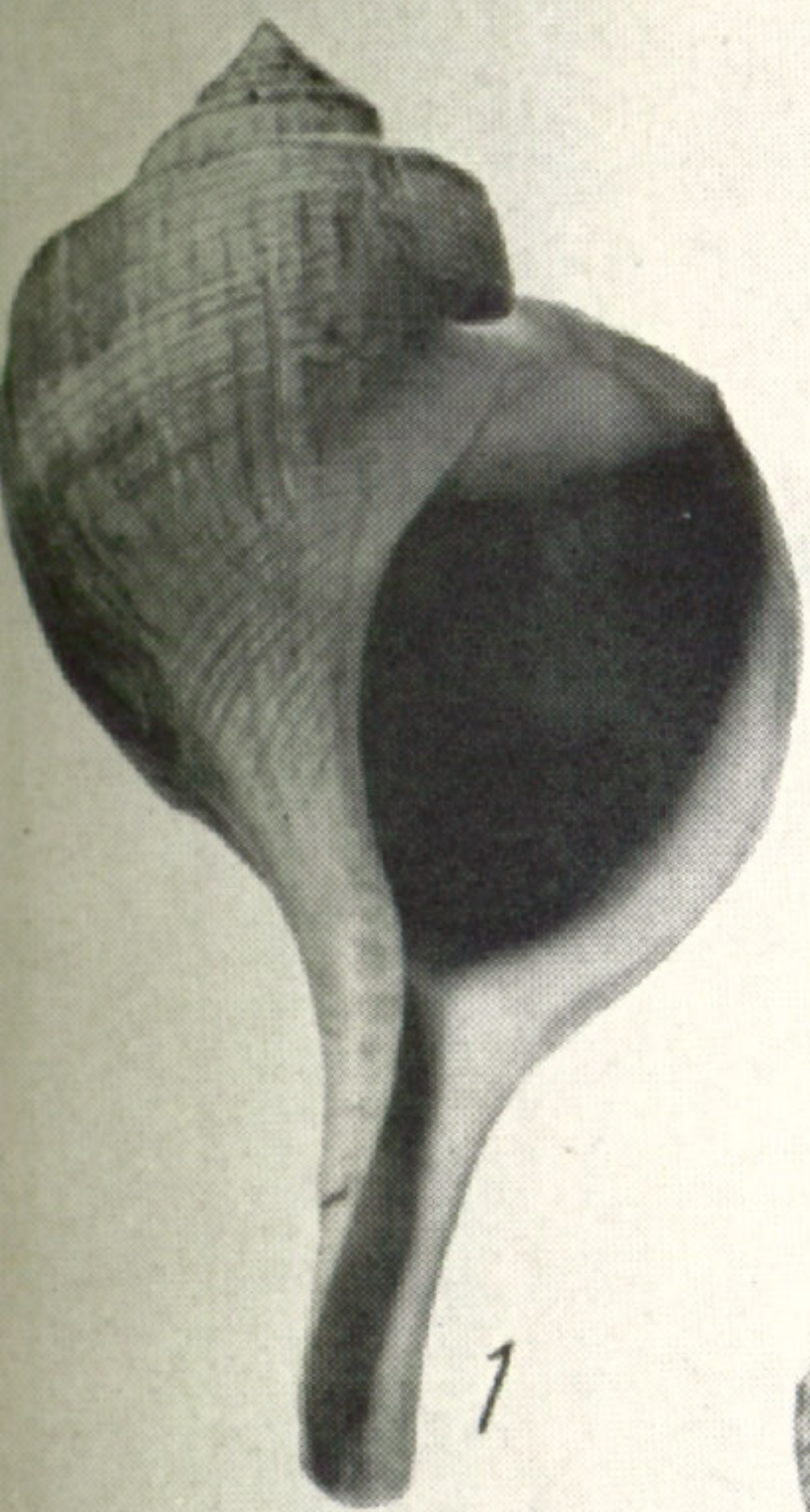
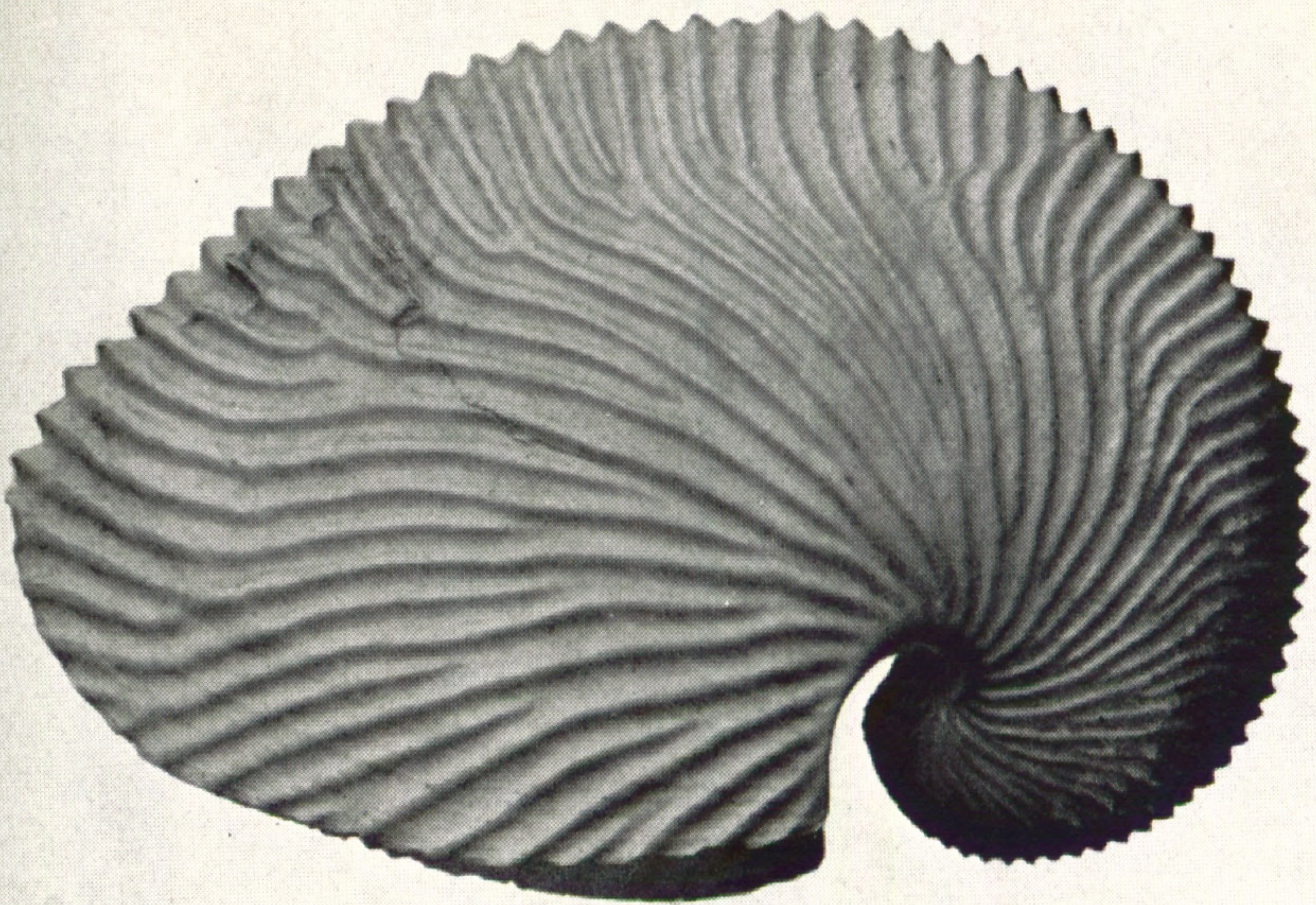


PLATE X

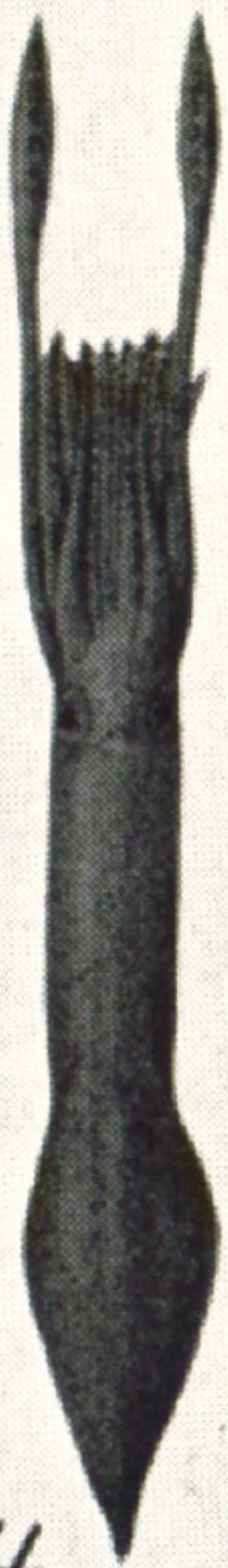
1. Paper Nautilus (*Argonauta argo*) ($\frac{1}{3}$ natural size). 96
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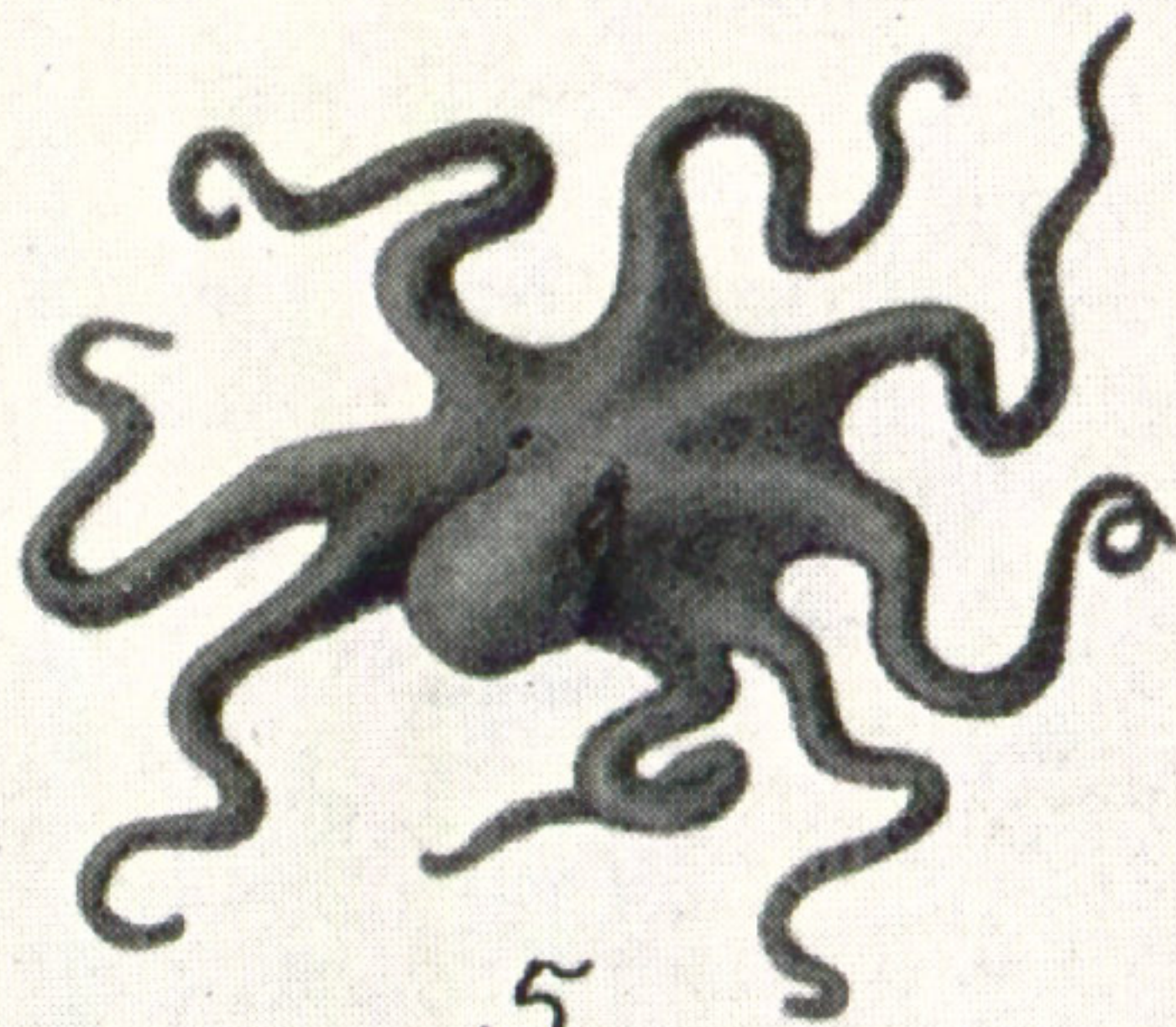
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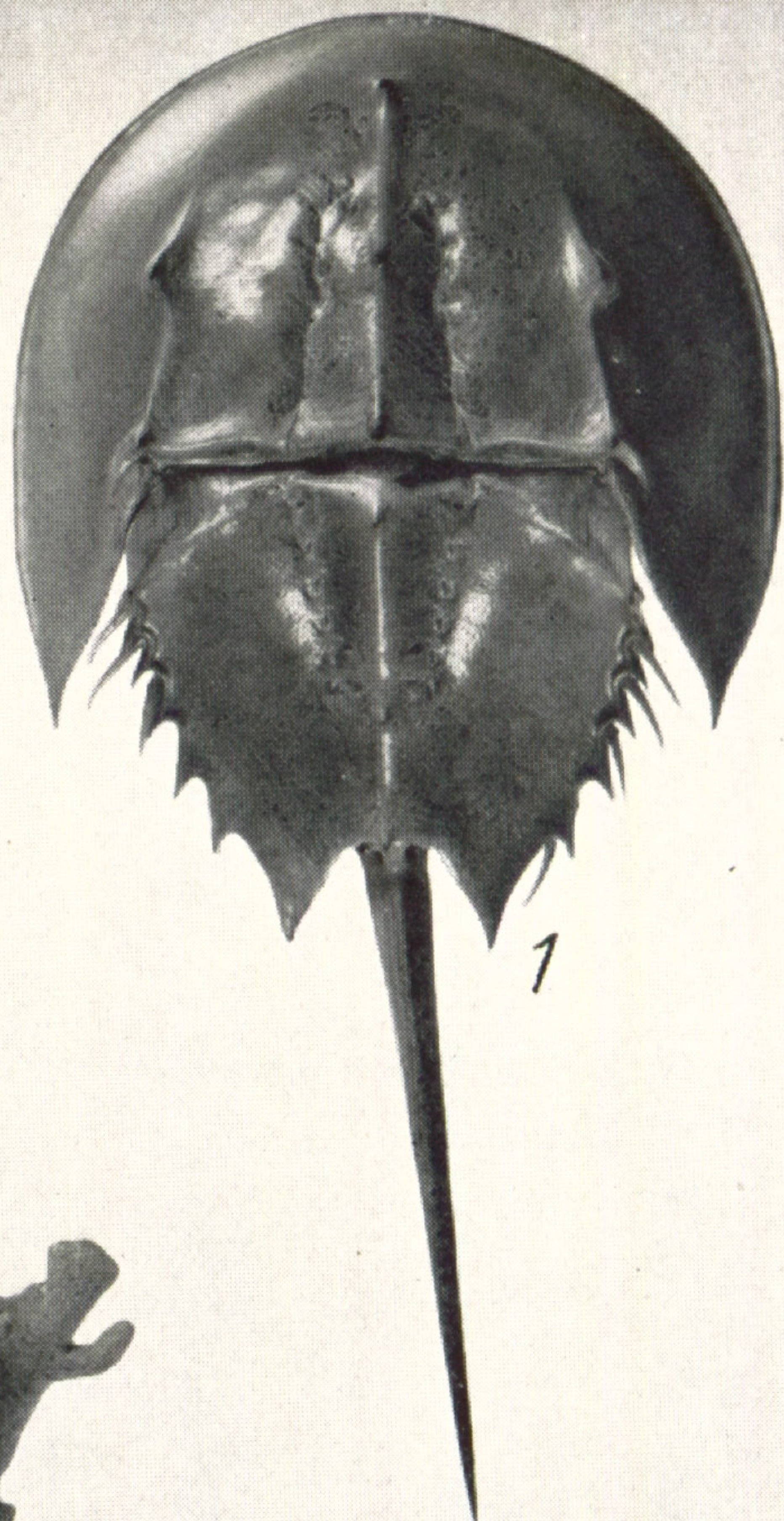
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PLATE XI ($\frac{2}{5}$ natural size)

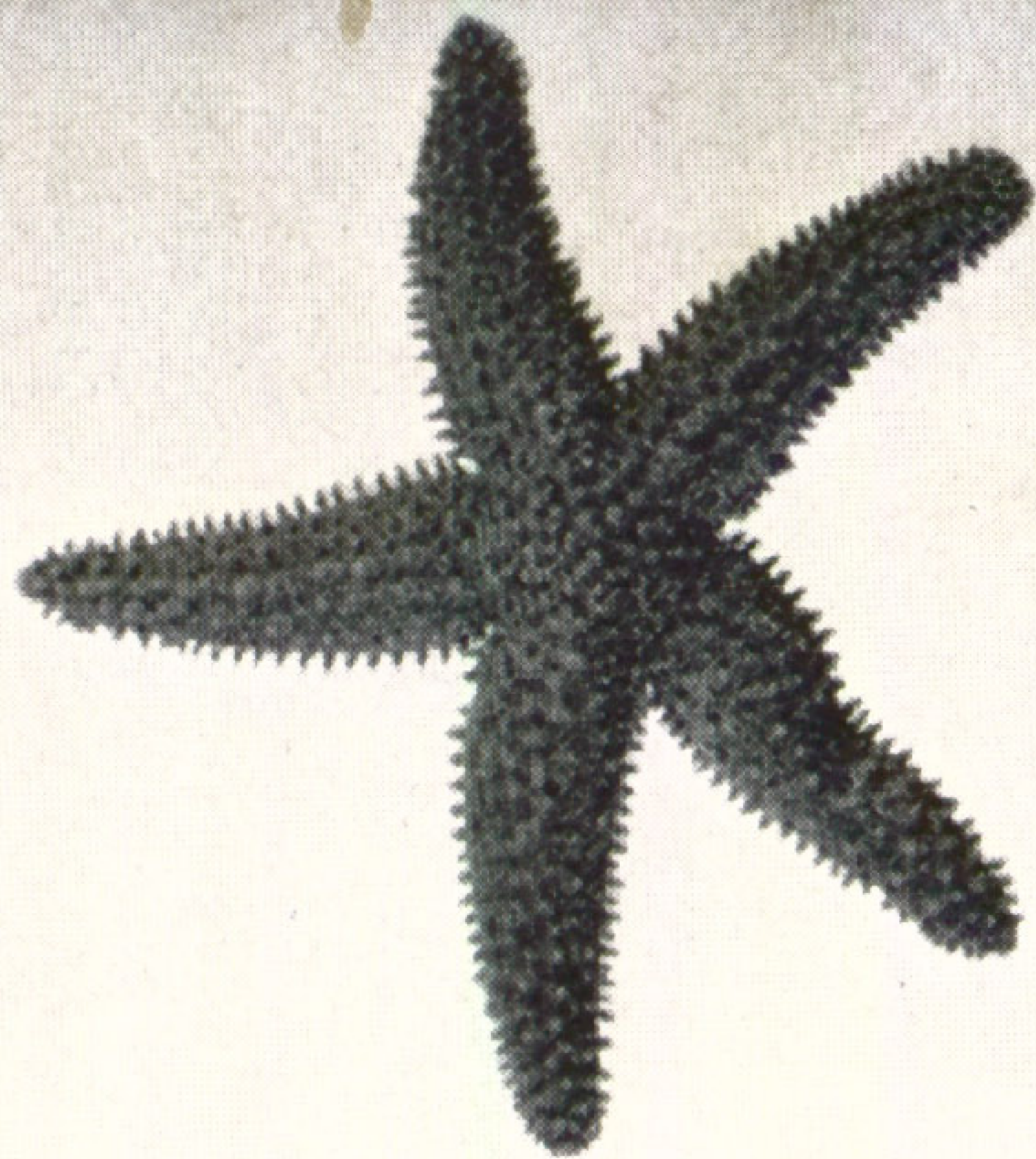
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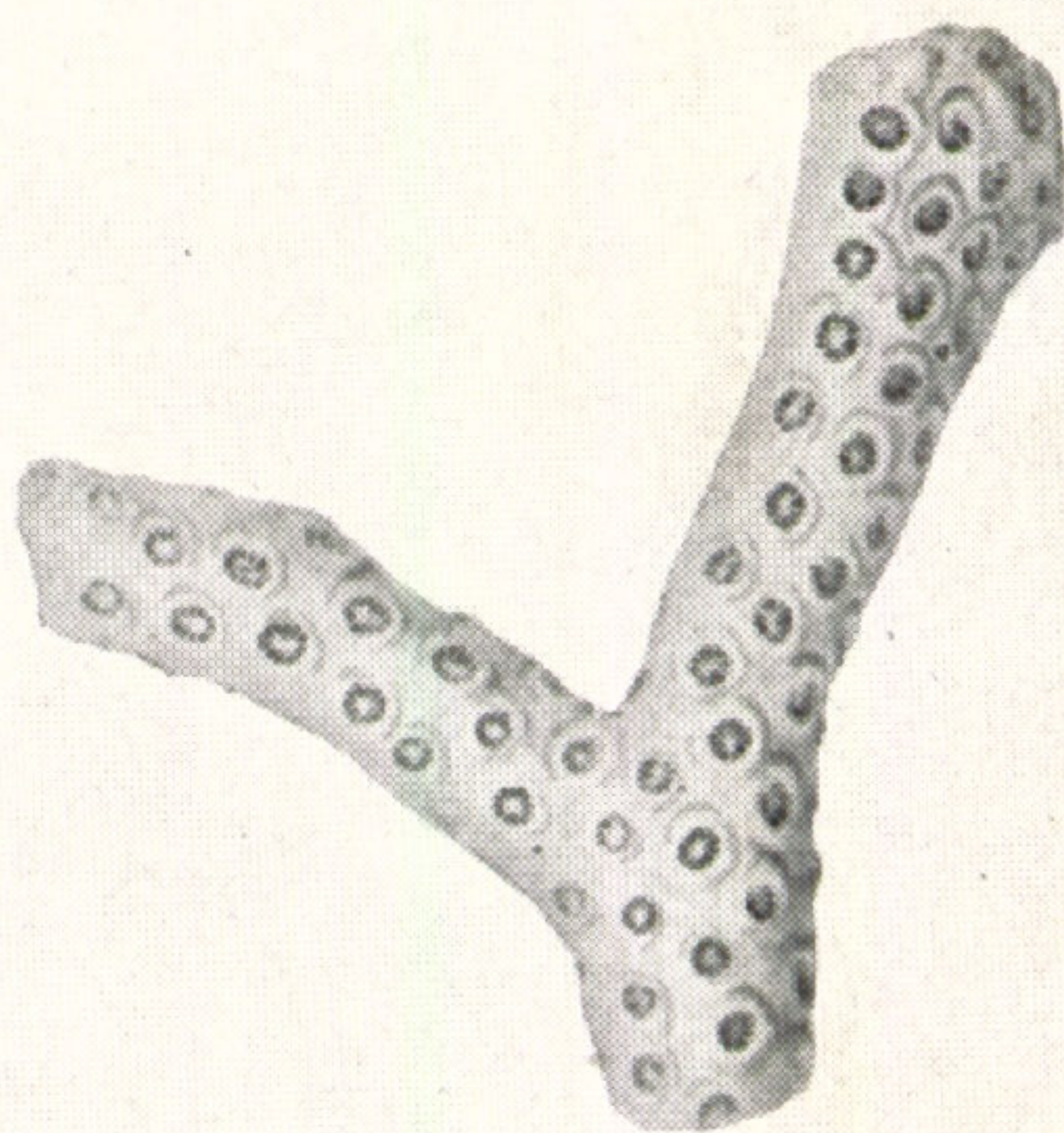
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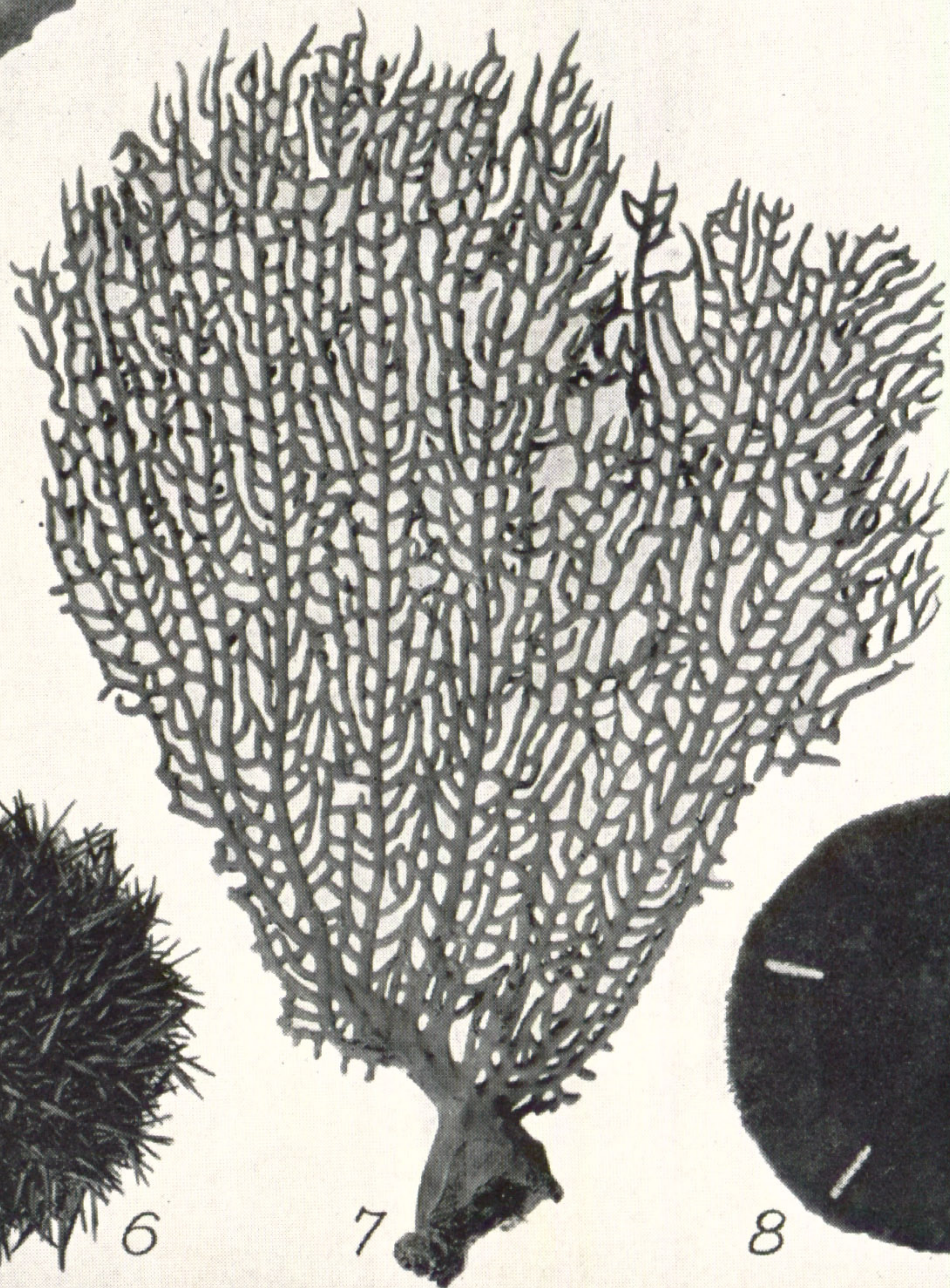
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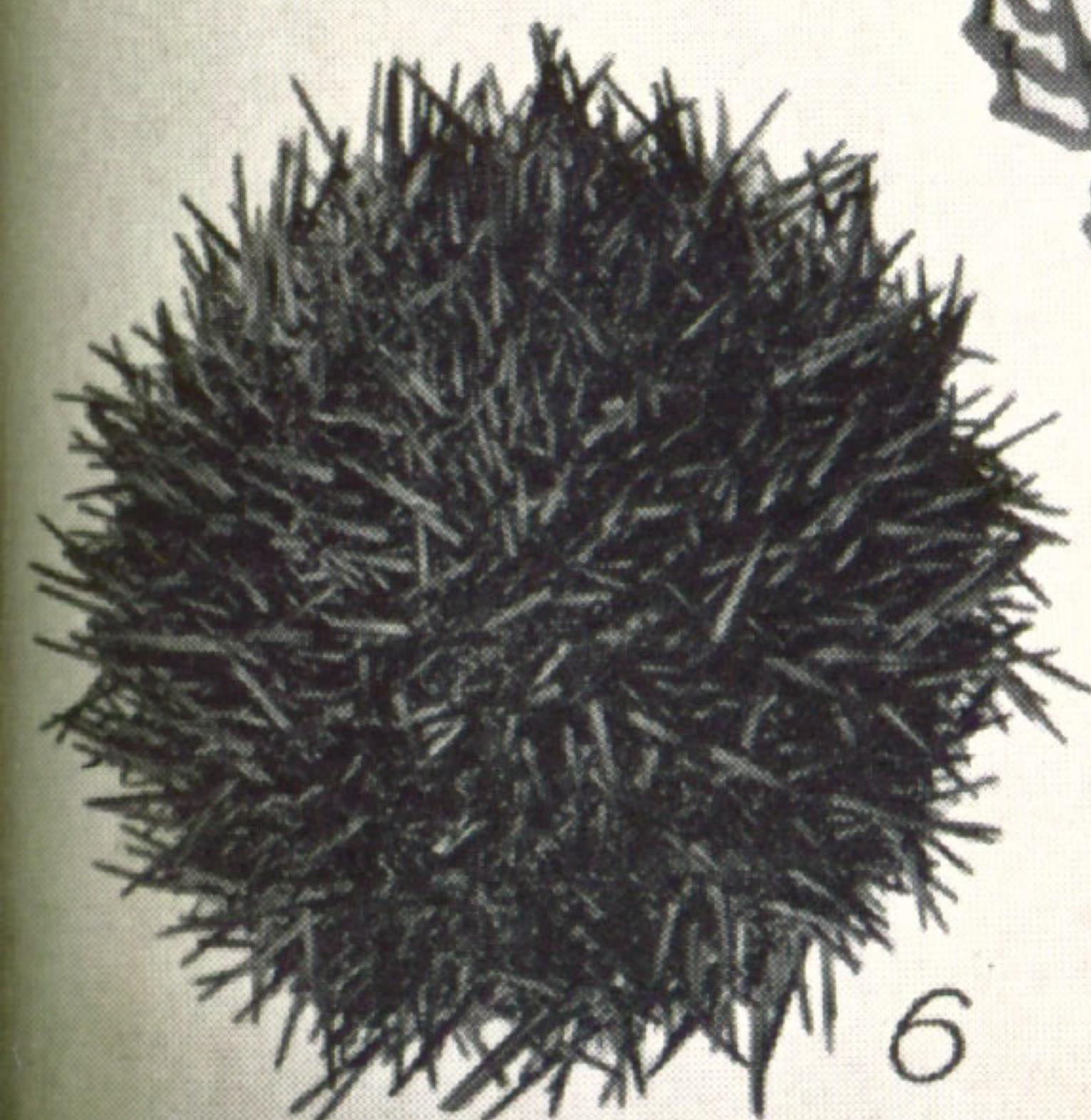
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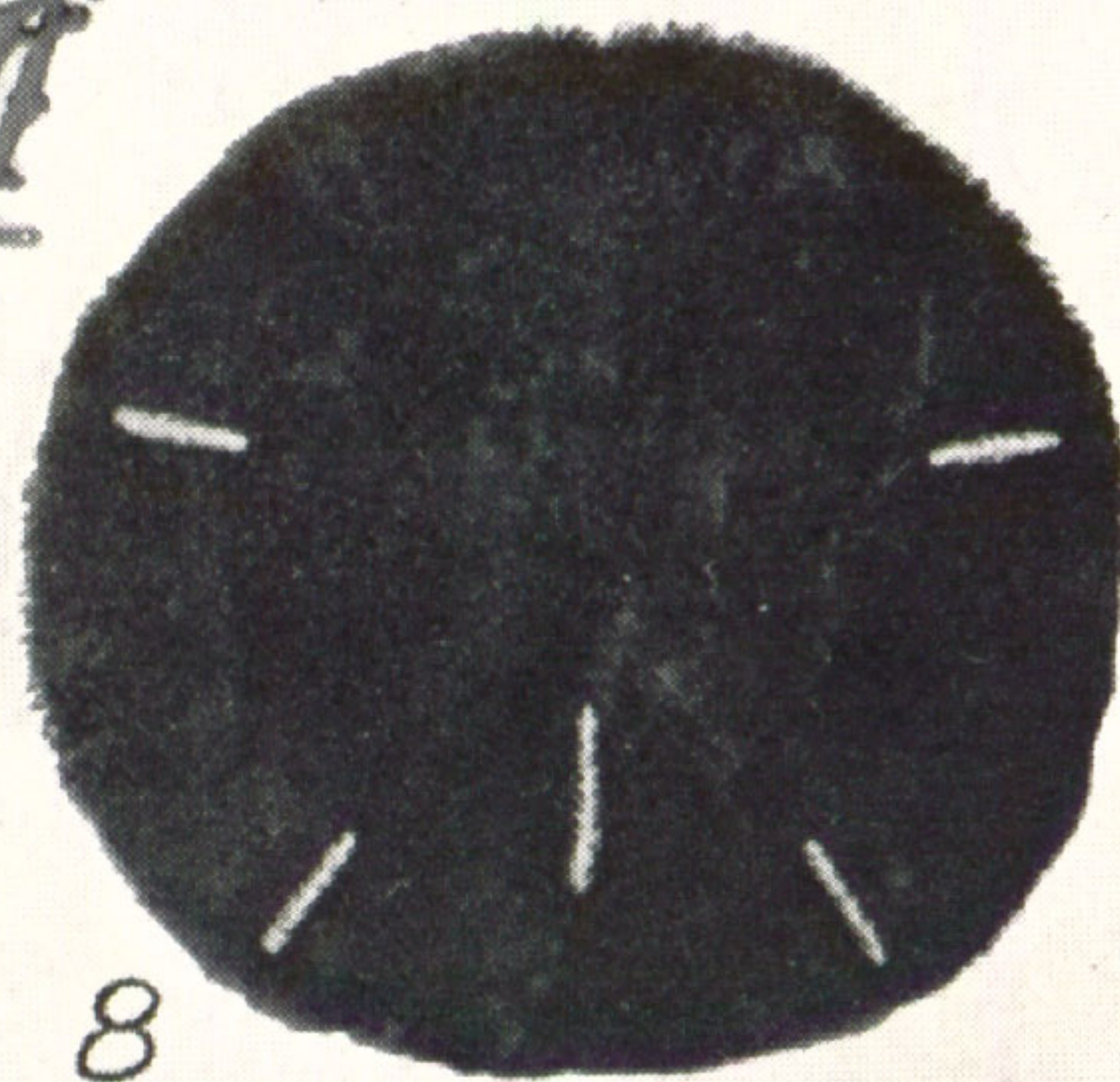
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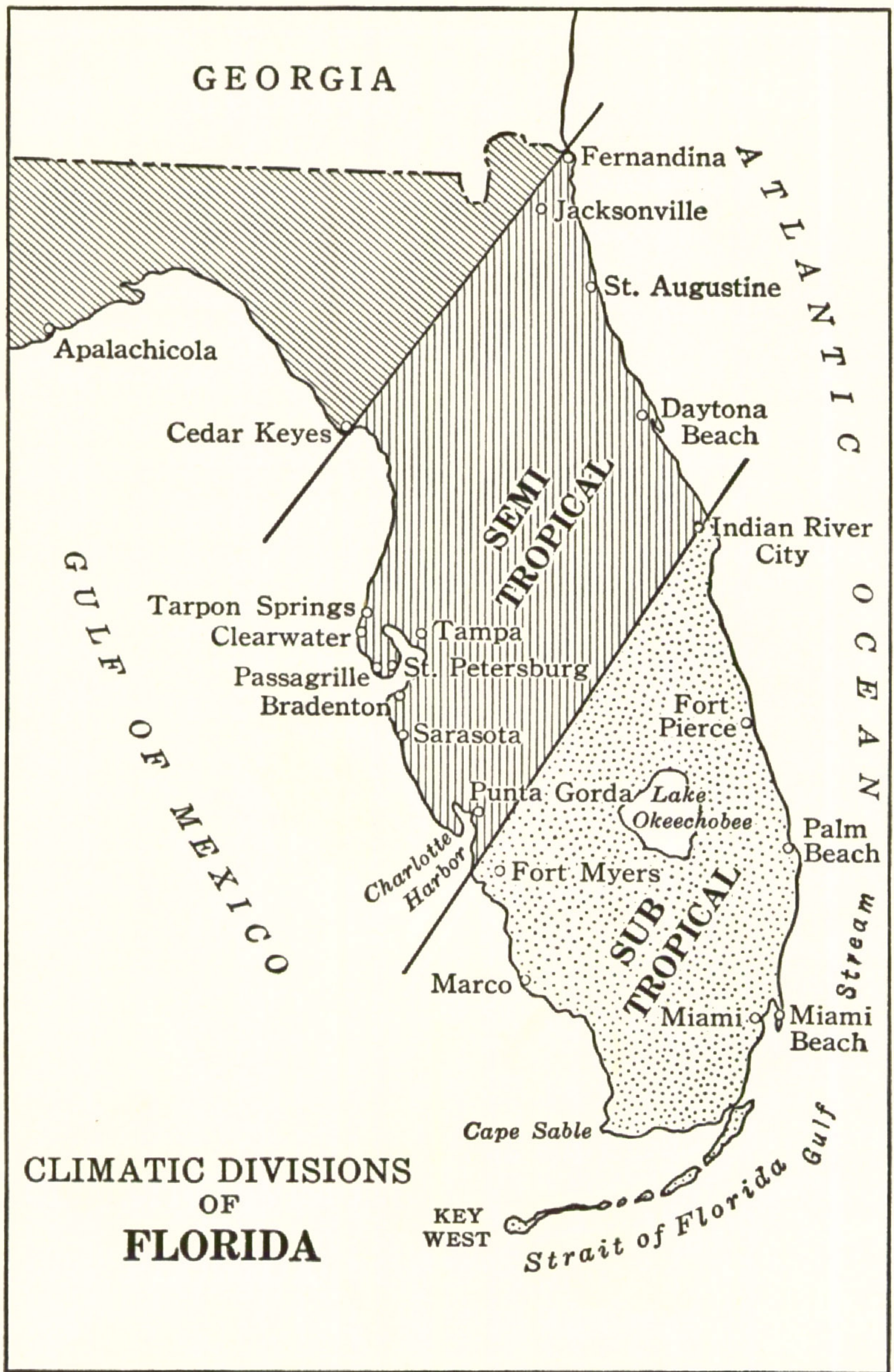


6



8

FLORIDA SEA SHELLS



I

ROMANCE OF THE BEACHES

FLORIDA, from its earliest history, has been a land of romance and adventure. The Spaniard came seeking gold he did not find, but the modern adventurer, if he be a shell collector, will be well rewarded for his quest.

The sea, with its treasures, has always excited the imagination. In ancient times the ocean was believed to be peopled with sea nymphs and mermaids. Oceanus ruled it, with Neptune and his triad. Fantastic pictures describing palaces on the ocean floor have filled the books of fairy tales. But nothing can equal the reality revealed to us through the modern equipment designed for exploring the ocean bottom.

Coral formations, purple sea fans, gorgeous seaweeds, brilliant-hued fish, queer creatures whose shapes and colors defy description, starfishes, crustaceans, and mollusks of all varieties, make a veritable dream world. Only a few are privileged to explore this new world for themselves, but many can and do enjoy the treasures tossed up lavishly on the beaches by the ever-recurring tides.

The collector of shells finds the Florida beaches abundantly loaded with the objects of his search.

The West Coast of Florida is particularly rich in varieties of mollusks and other sea creatures. The most famous beaches of the Florida West Coast are near inlets or on islands just off the mainland. To these beaches the rushing waters of the tides carry multitudes of shells.

At the southernmost tip of the Florida West Coast is Cape Sable. Stretching northward from this point, isolated and accessible only by boat, are beaches where shells are piled up in great mounds.

The Ten Thousand Islands, lying along the coast opposite Everglades City, have few beaches. A sandbar rising between the islands and the open Gulf prevents the mollusk from being washed to shore. The islands are covered with tangled mangrove trees. Oysters cling in masses to the roots of the mangrove. At low tide the roots and their burden of bivalves stand entirely out of the water and the clinging oysters are exposed to view. This phenomenon gives rise to the droll legend concerning the oyster that is able to climb a tree.

A few miles north of Everglades City is the splendid beach on Marco Island. A narrow shell road, leading off the Tamiami Trail, east of the town of Naples, will take you to the Gulf Coast, where you will be ferried across to the island. The settlement on Marco Island consists of a fair hotel, a few scattered dwellings, a general store, and many fishermen's huts with drying nets flapping in the wind. There is a large clam-chowder factory on the island. Great mounds of discarded clam shells dot the island in every direction.

A three-mile tropical trail brings one to a great horseshoe stretch of wide, white sand beach, miles long, bordered with clumps of tall cabbage palms and tropical growth. Shells are piled in profusion. The Mexican Gulf, blue as a turquoise, stretches calmly to the most distant horizon. Great black porpoises lift their fins and tails as they swim along; a lonely heron stands on one leg in the shallow water. Pelicans sail overhead in orderly file, following the leader; tiny sandpipers run along the beach dodging the oncoming waves. Mountains of billowy white clouds pile high in the cobalt sky.

Here the collector walks along the tide line picking up a golden-yellow buttercup shell filled with sea water, a rose cockle, a spiky white chest rock oyster with its lavender lining, or a Chinese alphabet shell just rolling back into the water with a receding wave. This lovely tropical beach stretches mile upon mile, untouched by civilization — beautiful, dazzling in the sun, gorgeous in color and splendor. This atmosphere of beauty and peace, absorbed by the collector and associated with his shells, is of greater value to him than the shell itself.

Cape Romano has a good beach; Naples, also. At Bonita Springs, four miles off the Tamiami Trail, there is an excellent beach. Here the eight-mile stretch between two rushing inlets is well combed by shell collectors during the winter season. At the north end of the beach is a fisherman's hut, with its palmetto-thatched roof. The fisherman's wife gathers shells at low tides. There is a ready market for her shells because of their wide variety. Her own col-

lection is of great interest to shell enthusiasts visiting this locality.

Sanibel Island near Fort Myers is most widely known for the great variety of splendid shell specimens found on its beach. The rare and beautiful *Junonia*, a deep-sea mollusk, is frequently found here, after a storm has stirred up the ocean depths.

Stretching northward along the West Gulf Coast from Charlotte Harbor to Cedar Key, either on the mainland or on adjacent islands, are many fine shell beaches. These beaches are the Mecca of shell collectors from all over the world. Many winter visitors to this section of the State have become collectors through their surprise and delight at finding so many varieties near at hand. The children are especially enthusiastic, and many adopt the study of shells as a permanent hobby. Some of the better-known beaches are at Punta Gorda, Sarasota, Bradenton, Passagrille, Clearwater, and Tarpon Springs.

The South Gulf Coast, though it does not offer as many shell beaches, is the locality where the commercial use of shells and their animal inhabitants has been built up. Here the oyster industry thrives, and those animals and shellfish that feed upon them are here too. Their shells are washed up on the shore or brought up by the fishermen and eagerly seized upon by shell lovers.

The Florida East Coast, though not so rich in shells as the West Coast, has, however, many varieties particularly its own. The northern half of the East Coast, extending as far south as Indian River City, is classed as semi-tropical, and the fauna of

this section is very different from the lower half of the State that is classed as sub-tropical. In the semi-tropical regions are oysters and coquinas and many other specimens of the temperate latitudes of the Atlantic Coast.

The northern part of the sub-tropical section, almost as far south as Miami, is also different in fauna from the southernmost parts and from the Florida Keys. This is due to the near presence of the Labrador Current that hugs the shore closely from Palm Beach to near Miami, where it disappears. But even in this cold current the marine life is warm temperate mixed with a few of the hardier tropical varieties.

The Gulf Stream, sweeping northward along the coral reefs, has a temperature of from seventy-five to eighty degrees and sometimes higher. In the shallower waters all life is tropical. As a rule the beaches of southeastern Florida are not so rich in marine life as those of the West Coast. The main reason for this difference is that the shore drops down rapidly to the bed of the Gulf Stream and there are few shallows where such life develops.

The beaches near Miami are very different in appearance from other Florida beaches. On the mainland beaches and those island beaches, such as Miami Beach, the sand is coarse and golden. Above the high tide line there is a wealth of tropical vegetation. Coconut and palmetto trees line the shores, and everywhere is to be seen the sea grape or *Coccolobis*, with its round, heavy, shiny leaves and its weight of purple fruit that may be eaten. The leaves of the

sea grape are rich and green in the summer, but in the winter change to autumn hues. Great masses of the *Tournefortia*, or sea lavender abound, with hoary leaves that seem to be covered with perpetual snow. Low yellow sunflowers grow everywhere and the goat's-foot vine, with its cloven shiny leaf, sprawls along covered with large purple blossoms that resemble the morning-glory. The shore is often piled high with the common gulfweed and many delicate algae, white, pink, and red, as well as green, are present. High above the tide line is a flat stretch of sand. Here many shells and seeds are to be found washed ashore. The rare *Spirula* is here and the delicate violet snail. The sea bean is found if one is lucky, and the round, salt-encrusted seed of the 'Bussu' palm (*Manicaria*) that has traveled three thousand miles from its South American home to rest at last on the shores of Miami Beach.

Along the Florida Keys to Key West, where there are a number of splendid beaches, many different tropical shells are found. The bleeding-tooth snails live on the coral rocks. The large pink-lipped conch is also found here.

At Key Vaca chitons are fastened to the rocks, and a blow from a chisel is needed to loosen them. Here also are tritons, cowries, and small coral. At Stock Island there are rocky shores, covered with bleeding-tooth snails.

Pen shells by the millions and quantities of the small purple snail are found at Key West. Lovely corals of many varieties are secured by the fisherman. Stands all along the road to Key West display

for sale corals, conchs, sea fans, and shells. The Dry Tortugas, a small group of islands about sixty-five miles west of Key West, have lovely corals and helmet shells and large conchs.

Charles Torrey Simpson fittingly expressed the glory and romance of the Florida shores when he said:

‘The brilliant sunlight, the beautiful sky, the masses of tropical rain clouds piled up and the intense and ever-varying color of the sea are all attractions of a Florida shore. One could spend a lifetime wandering along these beaches and reefs and still have much to admire and learn. Here are wonderful lessons in the distribution of life, in the adaptation of animals and plants to environment, in mimicry. One would constantly find the unbelievable and he would continually unravel problems in evolution and the mysteries and purposes of life.’

II

HISTORY OF MOLLUSKS VALUE TO MAN AND GENERAL CLASSIFICATION

THE first known study and classification of the mollusks was made by Aristotle. He recorded his finding in two volumes entitled *Historia Animalium* and *De Partibus Animalium*, and described the habits of mollusks with considerable accuracy. In 1685, Martin Lister laid the foundation for our modern classification in his volume, *Historiae Conchyliorum*. Cuvier, in 1799, designated Mollusca as one of the primary groups of the animal kingdom. Richard Curle, in his book, *Collecting American First Editions*, pages 31–32, makes mention of *The Conchologist's First Book: or, a System of Testaceous Malacology* (1839), written by our own Edgar Allan Poe. Of this work Mr. Curle has this to say: 'The spurious erudition of those last two words [Testaceous Malacology] was, if one may say so, Poe's only erudition on the subject of snails. At this length of time we may smile at any alleged interest, much less knowledge, by Poe concerning these insignificant animals, but in the eighteen-forties it was no laughing matter either for his pocketbook or his pride. The letter

illustrated here shows how scanty was Poe's real connection with this work, but how keen his resentment at any suggestion of plagiarism, even in malacology.'

Mollusca, excluding insects, is by far the largest of the invertebrate zoological groups. The *Encyclopaedia Britannica* notes that there are sixty thousand living and twenty thousand extinct species. Bartsch, in the chapter on mollusks in the *Smithsonian Scientific Series*, asserts that there are probably one hundred and fifty thousand species including the fossils. Many naturalists in the past two centuries have studied Mollusca and have written about them. As late as the year 1800 there were only two thousand known species, but in the past one hundred and thirty-five years thousands of new species have been named.

There are valuable collections of shells both in Europe and in America. Some of these collections are to be found in public museums; others are privately owned. The Smithsonian Institution, the Philadelphia Academy of Science, the Museum of Comparative Zoology, Cambridge, Massachusetts, the American Museum of Natural History in New York City, and the Academy of Science in Chicago all have splendid collections. Amateurs everywhere collect shells, shell collecting being a hobby as popular as coin or stamp collecting. Catalogues of shells are available from firms having for sale shells collected from all parts of the world.

People of wealth, interested in shells, frequently sail their own yachts to those tropical beaches

famous for beautiful mollusks. Many valuable species have been procured by such enthusiasts. Scientific expeditions are launched by learned societies and by public subscription, and are sent to the four corners of the globe, that they may bring to us at home specimens of every variety.

Mollusks have a wide range of habitation. They inhabit every climate. They live in salt and fresh water, on land, in trees, and on shrubs. There are mollusks able to climb, to crawl, to swim, to burrow, to dig, not only in sand, but into hard rock, to dive and to float. They vary in size from the giant squids of the North Atlantic, fifty feet long, to pin-head size. There are clams in the West Pacific weighing as much as five hundred pounds.

Different varieties of shells are found on the same beach at different times of the year. Sometimes there will be quantities of paper fig shells and later on none at all. During the month of March the whole pecten, that delight of collectors, is generally to be found on the Florida West Coast beaches. At other times of the year, it is difficult to find even a perfect single valve. Just as tropical birds and fishes are the most brilliant in coloring, so the greatest varieties and the most beautifully colored specimens of mollusks are to be found on tropical beaches.

Mollusks have considerable commercial value. The oyster industry, from which millions of dollars are derived yearly, ranks first. Scallops, clams, and cockles furnish food for man. In Europe some land snails are considered a delicacy.

In the Orient the octopus is a choice food. The

Greeks and Romans considered it the finest food furnished by the sea. Pliny tells us that the gourmands of Rome ate every variety of octopus known in the Mediterranean. The cooks baked the creature in a sort of big pie, cutting off the arms and filling the body with spices. Visitors to Italy, today, marvel at the fondness of the Italians for octopuses. They are to be had in almost any restaurant. There are many ways to prepare them. Those persons with a penchant for queer foods endeavor to cultivate a taste for this oddity.

Pearls are found in many pearly shelled mollusks. Mother-of-pearl is derived from the lining of shells. From fresh-water clam shells, pearl buttons are made. Cameos are cut from conch and helmet shells. Italian cameo-cutters are especially adept in this art. The Japanese, however, are the only people fully awake to the beauty of form and color in shells. They use this knowledge extensively in their art.

The purple dye of ancient times came from the secretions of the murex. At that time the manufacture of this dye constituted one of the principal industries. It flourished until an emperor decreed that purple should be used only for royal robes.

India ink was formerly made from the secretion thrown out as a smoke screen by the squid and the octopus.

The pen shells spin a silky thread. This thread is secured in sufficient quantities to weave small articles such as gloves.

Cowries and tooth shells were used as money by primitive tribes. The wampum of the American

Indian was made by cutting and grinding beads from the clam shell.

In the Philippines and in China the flat thin window shell is used instead of window glass. It tones down the tropical glare, and withstands the typhoon.

In Tibet, a shell with the whorl turned to the left is held as sacred. An enterprising American obtained a large quantity of left-handed whelks from the Florida West Coast. These he disposed of with considerable profit in Tibet. They were placed in the temples there.

Within the past few years the making of all sorts of novelties and souvenirs from shells has developed into one of Florida's very profitable industries. These souvenirs are popular with the winter tourists, and shops and stores throughout the area carry large stocks of all kinds of them.

Bartsch, in the *Smithsonian Scientific Series*, volume 10, page 253, describes how the fossil mollusk is used to determine the age of geological formations. We quote the following:

‘Perhaps no group of fossils is more used by the geologist and paleontologist to determine the age of geological formations than the shells of mollusks. These shells act as guides in the search for the treasures of the earth's crust, be these water, oil, iron, gold, diamonds, or the thousand and one other materials that we extract from the earth.

‘It is the shell also that furnishes us with information about the antiquity of Mollusca, for their fossil shells bear evidence that these animals lived as long ago as the early part of the Paleozoic era — well-

nigh the most ancient time from which animal remains of any kind are known; and the shells also bear evidence that these earliest known animals were already so highly specialized as to force us to the conclusion that their ancestors arose far back beyond Paleozoic times.'

Mollusca are invertebrate animals; that is, they are without a backbone. The shell is the animal's skeleton, secreted by the mantle for the animal's protection. The shell is formed and developed at an early stage in the mollusk's existence. This early shell is never shed, but added to in much the same manner that we develop our bones. The shell, whatever its shape or size, consists of three layers: an outer, thin, protective layer; a second, thicker layer; and an inner, very smooth, shiny layer that in some shells is pearly. One group of mollusks, the squids and octopuses, have no shells at all.

Many elements enter into the distribution of mollusks: the temperature of the sea; the salinity, depth, and pressure of the water; and the nature of the floor of the ocean. The Gulf of Mexico is shallow near the land and has a sandy bottom, while the Atlantic Ocean is deep near the shore with long stretches of coral reef making the bottom rough and rocky. Most of the Atlantic mollusks have heavy shells to protect them from the pounding of the surf. The mollusks of the Gulf Coast are more fragile.

Some people consider only the shell, but Mollusca has been classified with as much consideration for the anatomy of the fleshly parts as for the shell structure. 'Conchology' is the term used to de-

scribe the study of shells; while 'malacology' refers to the study and classification of the entire mollusk, both shell and the animal within.

The classification as given by the Smithsonian Institution is used in this volume, and is as follows:

CLASS	EXAMPLE
Pelecypoda (hatchet-footed)	oyster — bivalves
Scaphopoda (plow-footed)	dentalium — tooth shells
Gastropoda (belly-footed)	snail — univalves
Cephalopoda (head-footed)	octopus

The Scaphopoda and the Cephalopoda are limited to a marine home. The bivalves are found in both fresh water and salt. The only group living on land, as well as in fresh and salt water, is the Gastropoda which embraces the snail family. This group has the greatest number of species.

The question constantly is asked, 'How long do mollusks live?' In *Smithsonian Scientific Series*, page 255, will be found the answer: 'That is a question that cannot be answered for all forms. Where known, their duration of life extends from one to thirty years. The oyster is adult at about five years and lives for as long as ten. The garden snail has been known to live five years. The fresh-water mussels (Anodonta) may live for thirty years.'

Life is difficult at best for the mollusk. A great majority never reach maturity. Fish, crustaceans, starfish, and other sea creatures feed upon the succulent mollusk. Mollusks are sometimes carnivorous, and some even feed upon mollusks.

III

BIVALVES OR PELECYPODS

THE mollusk called bivalve is one with two shells hinged together, opened and shut at will by the creature within. These halves may not be of equal size, nor of similar color, nor quite the same shape. Oysters and clams are bivalves.

The muscles which open and close the shell are very strong. In order to open an oyster which has closed its shell, a special knife and strong arm are necessary. Scars are made by these muscles on the inside of the shell where they are attached and smaller scars are made by the attachment of the foot and mantle muscles.

The foot, which is usually quite sharp and points downward and outward, looking much like a hatchet, gives this family its name; Pelecypoda, or hatchet-footed. All bivalves at some time or other have this foot. The oyster in adult life has lazy habits and does not develop the foot with which it starts life. With this foot the bivalve can anchor itself to the ocean bed, dig down into mud, burrow into sand, pull its shell along, or even drill through a substance as hard as granite.

Bivalves have neither head, nor jaws, nor teeth.

The pectens or scallops have eyes, sometimes as many as one hundred and twenty, which are placed on the outer edge of the mantle and appear as tiny and brilliant specks.

When the shell is ajar, which is its natural position, the mantle appears as a simple flap. In some species it is fringed with bright-colored tentacles which wave gracefully. The mantle in some mollusks is even more beautiful than the shell itself. It is the mantle which secretes the shell. This shell is both the mollusk's stronghold and its skeleton. The mantle lines both valves and is attached to both. At one end of the shell the two mantle edges form two tubes or siphons.

In most species the siphons are not very long and can be tucked into the shell when the animal wishes to close it, but in a few species the siphons are several times longer than the shell, and are too large to be pulled in. Through one siphon water passes into the mantle chamber, and through the other water is discharged. Like fishes, bivalves breathe by means of gills, and the inflow of water supplies the gills with oxygen and the stomach with food. Minute forms of life are carried with the water through the siphons, and the bivalve has to take what food chance sends its way. However, it can by a straining process discard what it does not want and take what it chooses to eat. It is estimated that an oyster strains almost twenty gallons of water a day in order to get its supply of food and oxygen. Although the bivalve has a mouth, it has no teeth, and the food is pushed into a pouch-like stomach, where it is acted upon by the

digestive juices. It has intestines, kidneys, heart, and a blood circulation. The blood of most bivalves is colorless.

The nervous system of the bivalve is very simple. A few species have eyes, and the ear, when there is one, is in the foot. The instinct for self-preservation, even in the absence of eyes and ears, is developed to a point where, though the shell be tightly closed, it can defend itself effectively. The mollusk has many enemies, one of which is the starfish, which lives side by side with it. It smothers the mollusk by tightly wrapping its tentacles about the closed shell, shutting off the mollusk's supply of water and oxygen. In the clear, shallow water at Bonita Springs Beach, on the Gulf of Mexico, such a struggle with a starfish occurred where a group of shell collectors could actually witness it. A nine-legged starfish, seven or eight inches across, attacked a small yellow cockle. The cockle closed its shell tightly, but was not safe from the smothering grasp of the starfish. By some instinct the cockle sensed just the right second to strike. It opened its shell and quickly clamped down on one of the starfish's legs, completely breaking it off. The starfish at once loosed its hold and swam away, to grow a new leg. Life in the sea is a continual struggle for existence, and an alert shell collector can see many instances of it for himself.

Ordinarily, bivalves are either male or female, but careful observers have found that some bivalves have the ability to be female at one time and male at another. In some bivalves the eggs are passed into

the surrounding water by the female where, after fertilization, they undergo further development. In other species they are stored in the gills which serve as brood pouches in which a certain amount of development takes place.

Most bivalves have to contend only with their enemies of the sea, which are many, but the unfortunate oyster and a few other species are also preyed upon by man, to such an extent that some famous oyster beds produce less than ten per cent of the product of a few years ago. This, in spite of the fact that the fourth or fifth generations of a single oyster, if they all lived, would equal in bulk a planet five or more times as large as the earth. A single female oyster lays from ten to twenty million eggs in a season. The death-rate is very high. The young oyster furnishes food for herring and other fish. Many mollusks also feed upon the tender young bivalves.

Many bivalves have a free-swimming young stage in which they are much alike. There is present the gland which secretes a fragile transparent shell which is developed in the manner in which we grow our bones. Soon, however, the young mollusk begins to take on the habits and appearance of his own species. Oysters and clams settle down into permanent 'beds,' mussels and pen shells tie themselves by their byssus to a rock or suitable place; the ship borer finds some submerged wood to bore into where it can develop; the rock-boring species drill out a comfortable, safe, and permanent home for themselves; while the pectens, cockles, and other species move about, enjoying the freedom of variety.

Some species of bivalves have an additional gland in the foot with which they secrete what is called the 'byssus.' This is a bundle of hairlike threads of different lengths and thicknesses. These threads are used to attach the bivalve to some submerged object, and are very strong. It is difficult to pull a mollusk loose when it once has attached itself. Some species can climb up and down on this thread in much the same manner that a spider goes up and down its silken skein. In the Mediterranean countries the byssus is gathered and woven into articles. It has a silky texture and an olive-gold color. Gloves and even articles of clothing have been woven from these threads. The mussels, particularly the black mussels and the pen shells, have this gland.

The pest commonly called 'shipworm' is not a worm at all, but a bivalve mollusk. When very small, they bore their way into any kind of submerged wood, using their shells as files. Here they extend their siphons out to secure the needed water and food, and keep going deeper and deeper into the wood. They have sets of minute sawlike teeth on the edges of the shells, and with these they can cut through the toughest wood. As they push their shells deeper and deeper, the body grows longer and longer, until it is sometimes several feet long. Great damage is done to ships by these creatures. Wharves are destroyed. No kind of wood is safe from their destruction. Since one female lays millions of eggs in a season, and these in turn, in some species, mature in three months, it is impossible to estimate the damage they are able to accomplish.

The following is only a partial list of the shells of the bivalves that may be found on the Florida beaches of either coast after a storm or at low tide. This list is in no sense a complete one, but does contain the shells most readily picked up, and is for the purpose of identification only.

Nut Shells — Family *Nuculidae*

Most of the members of this family are northern in distribution. The southern species are usually found in deep water.

One of the common little bivalves found on all Atlantic beaches. This species occurs on the western Florida beaches.

Lantern Shells — Family *Periplomatidae*

The Lantern shells are thin and fragile and live in moderate depth.

A bivalve, rarely found on the Atlantic Coast and the Gulf Coast. This family is practically extinct.

Ark Shells — Family *Arcidae*

The ark shells are found on both coasts of Florida. They are very heavy, ribbed, with the valves equal and of the same color and shape. There are about one hundred and fifty varieties, found in all warm seas. They are box-shaped; the hinge is very strong; some species have red blood.

THE TRANSVERSE ARC (*Arca transversa*)

A small four-sided shell with opposite sides parallel and equal; scaly, and marked with heavy concentric

lines; one and one half to two inches in length. It is found on the Florida Keys.

TURKEY'S WING (*Arca occidentalis*)

This ark shell is found on both coasts, probably more frequently on the Atlantic side. A similar species occurs on the western coast of Mexico in the Gulf of California. It has a very decided resemblance to a turkey's outspread wing, and it will be easily recognized. The shell is very heavy, white, ribbed, and has brown markings which give it the feathery appearance. The hinge is as straight as if drawn with a ruler. The lining is chalky-white, edged with brown as evenly as if done with a paint brush. Some specimens found on the West Coast have a fuzzy epidermis along the lower part of the shell. This mollusk grows to a length of five inches and an inch in width, but smaller ones are more frequently found.

NOAH'S ARK (*Arca umbonata*)

This interesting shell is found mainly on the Atlantic Coast. Brown, ribbed, thick, it has much the appearance of an ark. Its outside finish is generally worn off, exposing the white lining. The shell has a warped appearance due to clinging to rocks and when the shell is soft being shaped by the object it clings to. Noah's Ark has the byssus gland in its foot and attaches itself to rocks. It has red blood, and also has a fringe of eyes on the mantle's edge. The hinge is a straight line, but is weak, so the whole shell is seldom found on the beaches. It can grow

to a length of five inches, but specimens about one and a half inches long are generally found.

CROSS-LINED ARK (*Arca reticulata*)

This is a small species kindred to those of California and Mexico; checked surface; small in size. It is found on the Florida East Coast, but is not abundant.

THE PONDEROUS ARK (*Noetia ponderosa*)

This species is found in abundance on Florida West Coast. Its most distinctive feature is the thick, black epidermis. One is inclined to believe that this shell has got into tar or ship's oil, it is so thickly covered, but soon discovers that this is part of the ark's own growth. The shells are white, very thick, boxlike, ribbed; the hinge is very strong, so that frequently the complete shell is found on the beach. The inside of the shell is chalk-white. When the entire shell is viewed sidewise, it has a heart shape.

The Pen Shells — Family *Pinnidae*

These are sometimes called fan mussels. The wedge-shaped shell is not unlike the old quill pen in appearance. The valves are equal. The shell is thin, rather fragile, of a horny substance, generally scaled, and with iridescent inside lining. Many varieties are found in warm seas. The shells are strewn over the beaches of the West Coast of Florida. They grow to a great size, and are often found complete. The pen shells have the unique ability of spinning a strong silken cord called the byssus.

PRICKLY PEN SHELL (*Atrina rigida*)

This is a triangular-shaped shell. The hinge side is straight, and the opposite side is curved. It is of horny texture with prickly erect spines. The interior is iridescent. It is plentiful on the Florida West Coast beaches, and sometimes grows to eight inches in length. Its most noted characteristic is the byssal gland.

THE HALF-NAKED PEN SHELL (*Atrina serrata*)

The shells range from six to ten inches in length. They are thin, of smoky, transparent, horny texture, and are covered with delicate scales. At the pointed end the scales are so thin that the iridescent lining shows through.

The Wing Shells and Pearl Oysters — Family *Pteriidae*

Live species of this family are now found only in warm seas, although some fossil remains are located in cold latitudes. There are approximately one thousand fossil, but only one hundred and twenty living species. The family Pteriidae is nearly extinct. The valves of the shells are always unequal. The hinge line is straight and extended. It has been said that the typical Avicula resembles the profile of a bird in flight.

A member of this family is the pearl-bearing oyster. Although the pearl oyster is not found in Florida, it is of such universal interest that a few details concerning it may not seem out of place.

The early Babylonians, Egyptians, Persians, and

Romans all valued the pearl highly. Much of the wealth of the Aztecs was in pearls, and early records tell of the fabulous pearls taken from the Aztecs by the Spanish conquerors.

The best pearls are found in Ceylon, in the Persian Gulf, the Indian Ocean, off the coast of Australia, and in the tropical waters of the Pacific Ocean. The Western Hemisphere is not, however, without pearl beds of great importance. Some of Florida's near neighbors are rich in pearl beds. There are fisheries, famous since the days of Cortez (1526), along the coasts of Lower California. These beds were badly overworked and almost destroyed by the short-sighted Spaniards, but after years of rest they were reopened and today are an important factor in that locality. Less important fisheries are located on the coasts of Panama, Costa Rica, and Colombia. Pearl-oyster beds are also at points along the coasts of Mexico and Nicaragua. From these American beds some rare black, green, and blue pearls have been taken.

Pearl oysters live at considerable depths and are brought to the surface by divers, one perfect pearl often meaning a fortune to its discoverer. The gem is formed from the same pearly substance (nacre) that lines the shells. This substance is secreted to protect the oyster from the irritation caused when bits of sand or the larva of worms enter into the partially opened shells. The finest pearls are found in beds where the oysters are overcrowded and ridden with disease. The pearly lining of the shell is called mother-of-pearl and yields, commercially, more value

than the pearls, as so few pearls of value are found in comparison to the amount of mother-of-pearl produced. Mother-of-pearl is used in ornamentation and for pearl buttons and novelties of jewelry. Only healthy oysters produce the best mother-of-pearl.

So certain is it that pearls will be formed that artificial beds are made for the pearl-bearing oyster and irritants are introduced mechanically into the shells. The Japanese are adept at producing artificial pearls. The Chinese even introduce small statues of Buddha and other religious objects to be covered by the nacre.

Different forms and colors of pearls are preferred in different parts of the world. Orientals prefer yellow pearls, while the black pearl is highly prized in Spanish America. The pink pearl has a wide range in color, varying from pale flesh pink to deep vermillion. The gray or smoky pearl is a universal favorite with men. The iridescent or Oriental pearl is very flattering to blondes, while brunettes look their best in white pearls.

The gem of greatest value is the perfectly round, opaque, and lustrous white pearl. Pear-shaped pearls are valuable and desirable. Styles of pearls often vary with changing fashions. There are pearls as famous and as much written about as the celebrities who have owned them.

Julia E. Rogers, in *The Shell Book*, devotes many pages to the cultivation of pearls.

ATLANTIC WING SHELL (*Pteria colymbus*)

The wing shell is found in Florida. It is from three

to four inches in length, and is a reddish-brown shell, with long slender points. The inside of the valves is iridescent mother-of-pearl.

PEARLY OYSTER (*Pinctada radiata*)

These are flat, square, drab wing shells with fringed edges, so light that the crests of the waves cast them high up on the beach.

The Oysters — Family *Ostraeidae*

The shells of the oyster are slate-colored and irregular. The valves are unequal, and are cemented to a support. The oyster has no foot, no siphons, and no byssus cord. There are about fifty living species.

Before the coming of the white man to America, the Indians living along the coasts used oysters as a staple item of diet. They dried or smoked them and bartered them with inland tribes. The oyster is widely distributed along our shores from Maine to Texas, and is found on the West Coast in San Francisco Bay and Puget Sound. The Western beds are sown with seed from the East. The Virginia oyster (*Ostraea virginica*) is the most succulent. New beds are generally seeded with this variety. It is commonly known as the Chesapeake Bay oyster.

The eggs of our oyster are cast into the sea where they develop into minute, free-swimming organisms that easily fall prey to other sea creatures and to the vicissitudes of a marine environment. Their rudimentary shell is fragile, but as it begins to harden the oyster attaches itself firmly to any available support and thereafter 'goes no more a-roaming.'

The oyster shell is made up of layers secreted by its mantle. The layers are added as the oyster grows, much as additional space is added to a dwelling to accommodate an increasing family.

Julia E. Rogers, in *The Shell Book*, pages 423-436, gives a detailed account of the family Ostracidae. Those wishing to know more concerning this mollusk will find her material very helpful.

Oysters of various kinds are found all along the coasts of Florida, both the East and West, and in many bays and inlets. They are also found far inland along the edges of streams and canals. Most of these oysters are not edible because they live in contaminated waters.

On the Florida East Coast, Fernandina has developed a thriving oyster industry, but the bulk of the development is confined to the South Gulf Coast. Saint George Sound and Apalachicola Bay are the chief locations. There are five large canning factories in Apalachicola and fish and oyster houses line the waterfront. Oyster farming is a principal industry in northwestern Florida and is one of the chief industries of the State. Commercially it amounts to several million dollars a year and thousands of persons are employed in its operation.

The State has appropriated large sums of money for replanting oysters on the natural coral reefs. Current and accurate statistics can be obtained from the United States Bureau of Fisheries, Washington, D.C.

The Apalachicola oyster is eaten extensively all through the South. It makes fine soups and broths,

and is delicious when baked or escalloped. It has a much stronger flavor than the Northern oyster.

The shipping of fresh oysters to inland points in Florida and throughout the South is extensive.

Not only the flesh of the oyster is processed, but the shells also. The huge piles of discarded shells are ground into flakes and shipped to poultrymen in all parts of the world for the consumption by their flocks. Crushed oyster shells formed the beds of many of the early roads of Florida. Some of these roads are still in existence. Even today some of the lesser traveled roads of northern and western Florida are made of shells. Oyster shells were used as building material by the Spanish settlers and ruins of an oyster-shell house and an old Spanish slave-house are still to be seen on Fort George Island, near old San Juan Mission.

TREE or COON OYSTERS (*Ostraea spreta*)

The roots of the red mangrove tree in southern Florida, on both coasts, are covered with masses of these small, rough, thick oysters. At low tide, when the roots are left above water, the oysters also are out of water. Thus it is that oysters literally 'grow on trees.' These are not much eaten because they are small, and not particularly good. Some animals feed upon them.

The Thorny Oysters — Family *Spondylidae*

This family has irregular shells, firmly attached, ribbed; the spines bear tiny mosslike scales. The hinge is composed of two teeth in each valve. These

teeth interlock. The thorny oysters live in warm seas, and derive the name from a resemblance to a small hoof. The shells range through all shades of all colors, and are much prized by collectors because of their color variations. The oysters have been known and eaten since the days of the early Greeks.

AMERICAN THORNY OYSTER (*Spondylus echinatus americanus*)

The shells of this oyster are found on the Florida East Coast. They vary in length from three to five inches, and may be bright yellow, orange, or red in color. The valves are similar to those of the scallop, ribbed. The spines vary from needle points to heavy spikes. It is very difficult to find perfect shells. They are usually broken by the pounding of the surf.

PLAITED SHELL (*Plicatula gibbosa*)

There are only a few living species of this bivalve. The shells are small, with braided surfaces traced with rusty hair lines. They accumulate a limy deposit as they age. They are found on the Florida East Coast, and are one inch in length. A smaller variety, *Plicatula mantelli*, is found on the Gulf Coast.

The Scallops. Comb Shells — Family *Pectinidae*

There are two hundred varieties of the family Pectinidae widely distributed throughout the world. Those found on the Florida coasts are among the finest. The best are to be found on the Florida West Coast. The shells are from one to two inches in diameter. These bivalves are shaped like a ribbed

fan completely opened. Earlike extensions project from the hinge line. A small notch in the side of the shell allows the byssal cord to emerge. The foot is not well developed. The shell normally rests upon the right valve, partially open. This right valve is pale and colorless, while the left valve is gayly colored and fancifully patterned. It is as if nature painted only the exposed side. By quickly opening and closing the valves the pecten is able to swim. The young pecten anchors itself by the byssal thread to the bottom of the sea, breaking it off when it wishes to swim about.

The creature within is more beautiful than the shell. It is brilliantly colored. The mantle edge is double-fringed and waves gracefully in the water. The eyes, placed in an even row, sparkle like diamond points. Occasionally bright yellow eggs, tucked neatly into the folds of the mantle, are visible.

In ancient times a large pecten shell was used as a drinking-cup. The Crusaders wore as an emblem the large pecten shell found on the shores of Palestine to signify that they had reached the Holy Lands. This shell was known as the 'Pilgrim's Shell.' Those who made the pilgrimage to the tomb of Saint James called their emblem 'Saint James's Shell.' A few noble families still have the pecten on their coat of arms, signifying that some ancestor had been a Crusader.

In France a large scallop shell is used as a baking dish. This shell gave to cooking the term to 'escallop.' The tender, delectable scallop is the muscle that opens and closes the scallop shell.

Shell collectors prize highly their pecten shells because of their wide variety of colors.

Julia E. Rogers, in *The Shell Book*, page 412, writes: 'To see hundreds of scallops the size of a silver dime flitting through the shallows on a bright summer day will certainly convince you that even mollusks can express the joy of living! At low tide the youngsters are to be looked for in tide pools and in the shallows near shore. They snap their shell lips together with a succession of clicking sounds; at each contraction of the great muscle a jet of water is thrown out under the ear, darting the body forward, sometimes a yard or more, always in a straight line. Changes of direction are made with great dexterity at the end of a stroke, a zigzag course enabling the mollusk to escape capture.'

CALICO SHELL (*Pecten gibbus*)

The shells are found in greatest variety of colors and patterns on the Florida West Coast, with a diameter of one to two inches. The colors most often found are bright orange, lavender with orange rays, purple, brown with white rays, white ground with mottlings of purple. The plain lemon-yellow is the rarest color. The under valve is generally white, with shadings at the hinge of purple or brown. One may have a complete assortment of colors in a pecten collection.

LION'S PAW or KNOBBED SCALLOP (*Pecten nodosus*)

This shell is found on both Florida coasts. It is a dark rich red or orange, with a diameter of three

to four inches. There are large knobs along the nine ribs of the shell. The ears are not equal. This shell resembles the spread-out paw of a lion. Perfect pairs are often found in shell shops in Miami.

The File Shell — Family *Limidae*

Only one file shell is found on the Florida East Coast. The surface is rough, suggesting a file, and resembles the scallop shell. The mollusks dart quickly through the water, hinge foremost, by opening and closing their shells. Their long tentacles trail behind them. They have the byssal gland. They build nests by making a web of the byssal threads and adding to it fragments of coral, broken shell, and seaweeds. The nest is small and funnel-shaped. The adult file has little room to move about, but it can run up and down, in spider-like fashion within the net.

ROUGH FILE SHELL (*Lima scabra*)

This shell is found on the Florida East Coast, and attains a length of two or three inches. It is covered with a yellowish-brown epidermis. Beautiful file shells are found in Bimini in the British Bahamas, east of Miami.

The Jingle Shell — Family *Anomiidae*

The shells of this family are roundish, warped, thin, and small. The valves are unequal in size, color, and shape. A large notch in the under valve near the hinge permits the byssal gland to function. The jingle permanently attaches itself to another

shell or to a fragment of rock. There is a great variety of colors.

SMOOTH JINGLE SHELL (*Anomia simplex*)

These shells are found on both coasts of Florida. Those of the West Coast are more brilliant in color and more fragile. The upper valve is the more beautiful of the two; cupped, roundish, translucent, solid color, no markings. The jingle shells are deep orange, yellow, salmon pink, white, slate, gray, and jet. The common name of this shell is 'Baby's Foot,' derived from an odd scar on the inside of the shell where the valves are attached. This scar bears some resemblance to a child's footprint. The upper valve is convex and the lower concave. A handful of these shells makes a pleasant jingling sound. They seem very fragile, but are not easily broken.

Julia E. Rogers writes in her *Shell Book*, page 419: 'The jingle shells when young settle upon some rough surface — an oyster will do nicely, or the hollow side of an empty scallop. If there isn't room for all, they cheerfully pile themselves, one upon another, each firmly riveted to the one below by the slimy byssus. Oyster dredges often bring up masses of jingles alive, shells all ajar. A tap on one of the outer shells causes it to close tight. As if signaled, the next one follows suit, then the next, until in succession they all sense danger, and are safely locked in.'

The Mussels — Family *Mytilidae*

The mussels are a large family, with many species widely distributed. They hang in bunches on pieces

of submerged wood, or on the wharves. Some mussels burrow; others build nests similar to those built by the file shells. They are edible and used also as fish bait. The valves are equal in size and shape, and are similar in coloring.

HOOKED MUSSEL (*Mytilus recurvus*)

This is a thick-shelled mussel with beaklike hook at the hinge end; dark or brownish in color; one to two inches in length. It is often found clinging to oysters, and is abundant on the Gulf Coast of Florida.

TULIP HORSE MUSSEL (*Modiolus tulipus*)

The length of this mussel is two to three inches. The species found on the Florida East Coast and in the Bahamas is oblong, with alternate rays of yellow and brown. The West Coast variety has an iridescent, orchid lining, with deeper stripes of purple or lavender. They are nest spinners. They have a brown epidermis, worn through at the top permitting the lavender lining to show through. Horse mussels are not edible. A beardlike fringe hangs from the bottom of the shell. The hinge is strong. Perfect whole shells are frequently found.

PEA POD SHELL or ROCK EATER (*Lithophaga bisulcata*)

A smooth chestnut-colored shell shaped like a pea pod; found on the Florida Keys. The shells become thickened with a limy deposit. When adult, they bore into the rocks and cannot be dislodged.

Pandora Shells — Family *Pandoridae*

Beautiful flat bivalves, found principally in cold water, a few go south to the tropics.

THREE-LINED PANDORA (*Pandora trilineata*)

A delicate bivalve with iridescent lined white shell. The lines parallel with the margin extend around the shell. It is found on the Florida East Coast.

Lyonsias — Family *Lyonsidae*

Thin and fragile shells found in moderate depth in shallow places.

TRANSPARENT LYONSIA (*Lyonsia hyalina*)

A very small bivalve found on the Atlantic and Gulf Coasts. The family is almost extinct.

Cyrenas — Family *Cyrenidae*

The members of this family have heavy shells with thin greenish, olive or blackish epidermis.

SOUTHERN CYRENA (*Cyrena carolinensis*)

A bivalve that lives in the mud of brackish water on sub-tropical coasts; two to three inches in length. It is found on the Florida East Coast.

Thick-Shelled Heart — Family *Crassatellitidae*

All the members of this family have very heavy shells with ponderous hinge.

THICK-SHELLED HEARTS (*Crassatellites gibbsi*)

A thick-shelled bivalve living chiefly in tropical regions. This species is found on the Atlantic Coast from Florida to Cape Hatteras.

The Carditas — Family *Carditidae*

The shells of this family are small but heavy, triangular in shape, heavily ribbed with the ribs radiating from one point at the hinge top to the edge. They are white, with ribs dark brown or marked with brown spots. The valves are equal in size, similar in shape and color. The inside of the valves is chalk-white. The hinge ligament is strong.

BROAD-RIBBED CARDITA (*Cardita floridana*)

These shells are found on both coasts of Florida, from one half to one inch in length. The bottom edge of the shells is very straight. Many beautifully marked varieties of Carditas are found on the western coast of Mexico in the Gulf of California. One of these is a deep pink with red markings. The Cardita has the byssus gland in the foot; but the triangular shape and pronounced ribs are the outstanding characteristics for identification.

The Rock Oysters — Family *Chamidae*

This group of shells has round thick valves, with spines. The valves are not quite equal. They have a small foot, and long siphons, and are found in tropical waters. They wedge themselves into the crannies in the coral reefs. In this manner the spines are often broken.

LEAFY ROCK OYSTER (*Chama macerophylla*)

The shell is found on both the East and the West Coasts of Florida; pinkish-lavender, violet, or lemon-yellow in color; length, one to three inches. It has lacelike ruffled edges on both valves. The valves are unequal and of irregular shape. They are brought up by fishermen from shallow water. Some fine specimens have been found at Miami. An unusual specimen observed there consisted of two perfect shells grown together, one a lovely violet and the other a lemon-yellow.

CHEST ROCK OYSTER (*Echinoe chama arcinella*)

This shell is found on the Florida West Coast. It is small, seldom more than one inch long, white, round, very spiny, and lined with a delicate purple. The hinge ligament is strong. The whole mollusk is often found.

The Lucinas — Family *Lucinidae*

The Lucinas have ribbed or latticed shells, small and depressed. They live in mud and sand of tropical shores.

THE PENNSYLVANIA LUCINA (*Lucina pennsylvanica*)

A variation distinguished by diagonal furrows about the posterior region; yellowish-white in color; two inches in diameter. The shells are found on the Florida East Coast.

THE BUTTERCUP (*Lucina jamaicensis*)

This shell is a thicker, less colorful, variety of

buttercup. It is not the perfect bowl shape of the buttercup (*Loripinus chrysostoma*) and the edge of the inside only is orange-color; the center of the lining is a rough white. This variety is also found on the East Coast; seldom in pairs. The valves are not quite equal in size, but are alike in shape and color. It is also classified with the Lucinas.

FLORIDA LUCINA (*Lucina floridana*)

The shells are dull white in color with yellow growth lines, and are found in abundance on protected sandy beaches of the Florida West Coast and the Florida Keys. They are small, about one inch in diameter.

TIGER LUCINA (*Lucina orbicularis*)

Ridges radiate from the beak of the shell and are crossed by fine concentric ridges; white in color; diameter three inches. It is found on all Florida coasts.

THE BUTTERCUP (*Loripinus alba*)

The valves of the buttercup shell are equal in size, similar in shape and color, and they are found on the West Coast of Florida. They are very beautiful, delicate bivalves, bowl-shaped, white outside, and the inside butter-colored. The hinge is fragile, and a pair is seldom found. They are washed up from the deep water, and are very abundant in all seasons. To walk along the tide line and find these colorful shells filled with sea water, which brings out the rich golden color, is a thrilling experience. The

yellow shows through the lining, giving the outside a faint color.

The Cockles or Heart Shells — Family *Cardiidae*

There are about one hundred species of cockles, found in many parts of the world. They have valves equal in size, color, and shape. When the entire shell is looked at sideways, it has a decided resemblance to a heart, and thus gives the species its name. The European variety is edible. The cockles go about from place to place, and have a well-developed foot. There is no byssus, as the cockle has no desire to stay put. They live in shallow water and dig down in the sand or mud. They are found on both Florida coasts.

THE ROSE COCKLE (*Cardium isocardia*)

This shell is found on both coasts, but those of the West Coast have more deeply colored interiors. The valves are equal in size, shape, and similar in color. The twenty-nine or thirty ribs start from the hinge top and radiate out to the edge, ending in a delicate scallop. They are close together and notched. The outside is pale tannish-yellow with splotches of reddish-brown. The polished interior shades from a delicate salmon pink to deepest rose, with shadings of purple, and some are shaded with orange. The rose cockle is one of the most beautiful shells found on the West Coast. The hinge is strong, and often lovely pairs are found. They are one to two inches in diameter, often smaller.

THE YELLOW COCKLE (*Cardium muricatum*)

This is a smaller species of cockle, found mostly on the West Coast. Both valves of the shell are similar in size, shape, and color. It has thirty ribs deeply chiseled, set close together, and notched with blunt spines. The outside is pale yellow with deeper yellowish-brown splotches, and the polished interior ranges from delicate yellow to deep rich shades of yellow. The hinge is not so strongly constructed as that of either the rose or the large cockle, so pairs are not found so frequently. Diameter, one half inch to one and one half inches.

THE LARGE COCKLE (*Cardium robustum*)

This mollusk has a large, rather heavy, closely ribbed home, yellowish-brown in color with markings of dark brown. The inside is a red-brown color. There are thirty-five ribs, rather flattened. The shells are strongly hinged together and pairs are found in abundance on the West Coast. The high seas wash them high on the beach and they are found up above the low-tide line. These shells are largely used in making souvenirs, and many of the contraptions in the gift stores — such things as ash-trays, inkstands, desk lamps, and what not — are made of them. They are also useful as individual baking dishes, as they withstand the heat of an oven. They develop to a diameter of five to six inches.

EGG COCKLE (*Laevicardium serratum*)

This shell is found on both coasts: smooth and

shiny as an eggshell. The East Coast specimens appear as if lacquered, they are so highly polished and are tinged with yellow, while those of the West Coast are tinged with a delicate pink. There are two valves equal in size, of similar color and shape. A variety is found in the British Bahamas which is smaller, a brilliant yellow within, highly polished, and called by the natives 'Butter Shell.' The egg cockles grow to be as large as the rose cockle — diameter, two to three inches. The shell is often found complete and oval in shape.

The Venus Clams — Family *Veneridae*

This family is named in honor of the goddess Venus. As befits the goddess of love and beauty, the shells are famous for their brilliant coloring, their sculptured and symmetrical shape, and their splendid finish. Species are found in both tropical and temperate waters. The tropical shells offer the greatest variety, both in color and shape.

DISK DOSINIA (*Dosinia discus*)

This shell takes its name from its discus shape. It is very flat, with not much room for the animal within. The surface is finely scored with concentric lines; the valves are white with a shiny yellow epidermis. The hinge ligament is extremely strong. There is a decided point at the bottom of the hinge. The shell is white, but the epidermis gives it a yellowish appearance. The lining is white. The valves are equal in size, and similar in shape and color.

ELEGANT DOSINIA (*Dosinia elegans*)

This is a small Venus clam. The shell has heavier ridges than its relatives. It is found on the Florida East Coast.

THE SUN RAY or GIANT CALLISTA (*Macrocallista nimbosa*)

Beautiful specimens of shells are found on the Florida West Coast. The name sun ray is given because of the rays which radiate from the top to the valve edge much like the rays of the setting sun. The shells are crossed with lines which give a plaid effect, and grow as large as five or six inches in length and two to three inches in width. They are polished, pink, with the cross-lines and rays in pinkish-brown. The hinge ligament is strong so that the whole shell is often found on the beach. The flesh of the clam is edible.

SPOTTED CLAM (*Macrocallista maculata*)

The shells are found on the Florida West Coast, but are rare. They are oval, very shiny, and not very large, seldom over three inches in length, with a width of two inches. The valves are equal in size, and similar in shape and color; light brown with spots of a reddish-brown. This is a very lovely shell. The flesh of the clam is edible, but has a peppery flavor.

CROSS-BARRED VENUS (*Chione cancellata*)

The shells are found on both Florida coasts, but more abundantly on the West Coast. They are small, with valves equal in size, shape, and color. The narrow ridges cross on the surface of the valves in

a cross-barred pattern. The lining is sometimes a deep orange, sometimes purple. The outside is a cloudy white, light tan, or gray. The East Coast has a brown species. The shells vary from one half inch to one and one half inches in length.

ROUND CLAM or HARD-SHELLED CLAM (*Venus mercenaria*)

This is the clam known as 'Little Neck' or 'Quahog.' It is the edible clam. The creature is active, rarely burrows into the sand, and seldom attaches itself by the byssus. The shell is very thick, ridged, and the inside has a wide purple margin. The early American Indians used this purple portion in making wampum. The purple wampum was worth twice as much as the white. From its use as money, this clam derived its name 'mercenaria.' On Cape Cod it is raked up from the mud flats by 'clam diggers.' In the South it reaches a size of six inches in diameter and weighs often as much as five pounds. There are clam-chowder factories along the Florida coasts, one well-known one being on Marco Island in the Gulf of Mexico. Great mounds of clam shells lie all about the plant. The young clam is as tender and as tasty as the oyster, but the adults become tough.

The Tellen Shells — Family *Tellinidae*

A large family, living in sandy or muddy shallow water; widely distributed. This mollusk has no byssal gland, its mantle is fringed, and the valves are equal. The hinge is so delicate that one seldom finds a complete shell. The tropical species are the most brilliantly colored. This group contains some of the finest of bivalve species.

THE LINED TELLEN (*Tellina lineata*)

This is a rounder variety of tellen shells, pink-rayed and elongated with a twist to the valves distinguishing it from other small tellens. It is found on the Florida Gulf Coast.

SUNRISE SHELL (*Tellina radiata*)

This bivalve grows from three to four inches in length, and is found on the Florida East Coast and at Key West. A fine variety is obtained from Bimini in the British Bahamas. Live specimens hiding just below the surface of the sand can be dug up at low tide. The shells are translucent, shiny white, with three broadening rays of rosy color extending from the hinge to the edge of the valves. There is a splash of yellow around the hinge, and an overlay of pale greenish-blue. The effect is that of the rising sun.

ROSE PETAL (*Tellina alternata*)

The rose petals are more abundant on the Florida West Coast. The curled edges of the shells remind one of tea-rose petals; delicate pink in color. There is also a yellow variety. It is from two to three inches in length.

SAYE TELLEN (*Tellina sayi*)

A small shiny white shell about two thirds of an inch in length; rounded front and with pointed end. It appears on the Florida East Coast.

THE IRIS TELLEN (*Tellina iris*)

An iridescent white shell with pink rays and circles

on each valve. The margins are thin and sharp; one half inch in length. It is found on the Florida East Coast.

PINK TELLEN (*Macoma tenta*)

This shell is found on the Florida East Coast. It is very small — one half inch in length; dull white, with the rosy pink from the inside showing through, resembling a pink thumb nail: dainty and fragile. The mollusk is found on sandy beaches, living just below the water line.

Semeles — Family *Semelidae*

Most of the shells of this family have uneven valves; the end is usually upturned.

RAYED SEMELE (*Semele proficua*)

A small bivalve whose shells are flat and circular, with the valves rayed with rosy pink, and a yellowish lining; one inch in length. It is found on the Florida East Coast.

Wedge Shells — Family *Donacidae*

These live mostly between tides and are very active burrowers.

VARIABLE WEDGE SHELL (*Donax variabilis*)

This mollusk is also called coquina or pompano clam. It is very tiny, scarcely reaching one half inch in length. A delicious and nourishing broth is made from the wedge shells. An Englishman, who had become familiar with this tasty soup during the

winters spent at Bonita Springs, Florida, ordered 'Coquina Broth à la Florida' served as a special treat to his dinner guests at the Waldorf Astoria. The soup cost well over a dollar a plate, but the host was amply repaid for his thoughtfulness by the delight of his guests.

The clams are found in profusion on many Florida beaches. They live in the sand just at tide line. As the waves recede, they are to be seen burrowing into the sand with their small pointed feet. They are dug from the sand with shovels and sorted by running them through a sand sifter. It is not difficult to obtain quantities of this tiny mollusk.

The shells have a greater variety of color and pattern than the butterflies that they so strongly resemble. There are pink, lavender, blue, green and white, red and yellow ones. Plaid varieties are in shades of brown and blue and yellow. A pattern designer might find the color combinations of the wedge shell very practical.

These shells are used in the making of countless shell novelties, such as dainty flowers and butterflies on hand-painted place cards, portières, and window curtains.

The Razor Clams — Family *Solenidae*

The razor clams live in warm waters. They are easily located by the jet of water thrown up when they pull the siphon into the shell. The shells are long, narrow, and straight, with razorlike edges. They are able to dig and bury themselves vertically in the sand. Razor clams are eaten in Europe, but not in the United States.

THE GREEN RAZOR CLAM (*Solen viridis*)

This is the only variety found on the Southern beaches. It is about two inches long, and has a light green epidermis.

The Surf Clams — Family *Mactridae*

There are about one hundred and fifty species, chiefly found in tropical seas. The shells are three-cornered and heavy, on the whole.

SOLID SURF CLAM (*Spissula solidissima similis*)

This is the largest of clams. The valves of the shell are very solid, and growth lines mark the surface; longish, white with yellow epidermis. These clams live chiefly in tropical water; are edible, and also are preyed upon by starfish and whelks. The clams have strong feet, which enable them to leap when trying to escape from their enemies. They burrow into the sand, and develop to a length of seven inches. The solid shell was used by the Indians as a hoe for working their maize fields.

CHANNELED LABIOSA (*Labiosa lineata*)

The shells of this species are found on the Florida West Coast. They are chalky-white, fragile, deeply grooved, the front half swollen, and quite flattened behind, with a delicate hinge ligament, seldom found complete. They are so light in weight that they are generally found high up on the beach. They are two to three inches in length, and are found, though not so plentifully, on the East Coast. The shell has no lining, but the outside grooves plainly show through.

Little Basket Clams — Family *Corbulidae*

Small shells with unequal valves, living in sand or mud.

BASKET CLAM (*Corbula contracta*)

An interesting little bivalve that lives in sand or mud; found on the Atlantic beach of Florida.

Angel Wing — Family *Pholadidae***ANGEL'S WING (*Barnea costata*)**

The shells are found on the Florida West Coast. The mollusks burrow down several inches into the sand or mud and a number of them live together. The valves of the shell are white, long, narrow, ribbed, and bear a decided resemblance to the conventional picture of an angel's wing. They grow to be seven or eight inches long. The people of Havana consider this mollusk as one of their stable sea foods. The two valves are connected only at a point near the tips: a lovely, fragile shell.

Shipworms — Family *Teredinidae*

Long worm-like mollusks burrowing in wood. Very destructive to pilings and unprotected shipping.

SHIP WORM (*Bankia gouldi*)

A wormlike bivalve that bores into piling, ships' bottoms, or other submerged wood, by means of its shell. In tropic waters they often grow two feet in length.

IV

UNIVALVES OR GASTROPODS

THE univalve is the mollusk whose house consists of but a single shell. It is also called Gastropoda, or belly-footed. This is the largest family and the most widely distributed. They live on land and in the sea; in salt water and fresh, and even in tall treetops in the tropics.

The most common form of shell is the cone. It begins as a small capsule and adds coil to coil at the open or mouth end, each coil becoming larger as the body of the animal grows, until it is full-grown. The coils nearly always whorl to the right, but a few whorl to the left, as the left-handed whelks. Some have no coil, but are like inverted cups, such as the limpets and the sea ears.

While univalves are much alike structurally, they differ greatly in the size, finish, and shape of the shell house. They range from the tiniest snail, no larger than a pinhead, to the great horse conch of the Florida Coast, which is two feet long and weighs often as much as five pounds. There is also the sea worm which looks like a petrified angle worm. The outside finish of univalves may be smooth and shiny, or spiked or knobbed or ribbed, and of a great variety of colors.

The opening through which the animal comes out of its shell is called the 'aperture,' and the shape and size and ornamentation of this opening varies greatly in different species. In some families there is great diversity in the different species. Most univalves have a strong door called the 'operculum,' which closes the aperture tight after the animal is inside the shell. This door grows on the end of the foot, which is the ideal place for it, as the foot comes in last. With this door tightly closed, the creature is safe inside its fortress. This is much the same idea as the closing of the old drawbridge in mediaeval castles! All gastropods do not have this door, however.

The most essential organ to the well-being of the greater number of univalves is the long file-like tongue, called the 'radula.' This tongue is used for getting and grinding food. It is equipped with countless teeth which literally rasp or scrape the food to pieces. The carnivorous univalves have fewer and larger teeth, and the vegetarians have smaller ones and more of them. An interesting fact concerning the snail is that new sets of teeth are constantly developing ready to take the place of the old ones as they become worn down. The number of teeth in some reaches many thousands. This tongue is sometimes twice the length of the mollusk. Some species have jaws, but the tongue is what counts. The digestive system consists of mouth, esophagus, stomach, and intestines.

Univalves have a heart, liver, kidneys, colorless blood, and a simple nervous system. Some breathe

with lungs, but more often they are supplied with gills. A species of chiton has several thousand eyes scattered over its shell, while some univalves have only a single pair of eyes located in different positions on the tentacles. Some have no eyes at all. But with or without eyes, mollusks are sensitive to light and dark. Some like the light, others find it disagreeable. Some can see no more than to distinguish between light and dark, while others have very good vision, and can see for some distance. Some start life with eyes, which in adult life become overgrown with skin and are useless. This is comparable with the peculiarity of the adult oyster, which fails to develop the foot with which it begins life.

The organs of hearing consist of a pair of ear sacs, like small, white points, located on the foot. There are no auditory canals leading to the ear sacs from the outside.

The shell lining is called the 'enamel' and is generally highly polished and beautifully colored. The mantle is the fleshy part which covers the body and lines the shell. Univalves have the senses of touch, smell, sight, and hearing. The entire bodily surface, particularly the foot, is sensitive to touch. The tentacles on the head are adapted to feeling. Everyone has watched the snail stick out his horns or tentacles. Closely connected with the breathing organs is the sense of smell. Those mollusks which eat decayed animal matter locate it by smell.

The broad sole of the foot of the limpets and California abalones enable them to secure a firm hold on a rock or other support by suction, so that it

is almost impossible to pull them loose. To surprise them with a sudden shove or pry them loose with a sharp weapon is the best method. They also use atmospheric pressure. The limpet, scarcely one inch in length, has had a twenty-pound weight suspended from it which it has held up for a few seconds. Wordsworth has well written:

Should the strongest arm endeavor
The limpet from his rock to sever,
'Tis seen its loved support to clasp
With such tenacity of grasp,
We wonder that such strength should dwell
In such a small and simple shell!

The abalone is much larger than the limpet and has much greater suction power. Authentic records show that persons seeking to pull abalones from the rocks to which they attach themselves have had their hands so firmly clamped and held by this suction that they were unable to free themselves and have so perished in the incoming tides.

The sexes are distinct in some gastropods, in some they are both male and female. All reproduce by the means of laying eggs. These eggs are laid or stored in the brood pouch of the female for further development. One sea slug lays many thousands of eggs in each batch. All are encased in an egg ribbon which the slug coils into a cluster and fastens to a rock. One land snail averages less than one egg a day. Eggs may be deposited one at a time or they may be enclosed in capsules. These capsules are then joined into long chains or egg ribbons, or stuck into a mass. These capsules are very tough, parchment-

like, and the ribbon type makes a whorl around a center cord. They are truly remarkable, and in late winter many of these empty ribbons and cases are washed up on the beaches.

The whelk egg case looks like a coarse sponge, and each capsule contains many eggs. There are as many as five hundred capsules to each mass. As they hatch, the larger baby whelks eat up the smaller ones, so that not a great many finally develop into adult whelks. The eggs are laid in the winter. It takes two months for them to hatch and develop.

The tiny violet snail has still a different method of caring for its eggs. It secretes a clear gelatine-like raft or air float which is attached to its foot, with the eggs fastened to the underneath side. This raft assists the fragile creature to swim.

Many times a small mollusk will fasten its egg case to the ribbon of a larger mollusk which is already fastened to a rock or coral reef below the water.

The univalves have not the great food value for man that the bivalves have, but the abalones have a market value in California. Snails are cultivated for food in Europe. The English do not relish them.

Snail culture dates back into Roman history as far as 51 B.C. The Roman maintained snail preserves and fattened the creatures upon new wine and meal.

In the West Indies, the Bahamas, and on the Florida Keys the conch is highly esteemed for conch chowder. An unnecessarily cruel method of getting the conch out of its shell is used. The animal is tied to a taut line and allowed to hang there until the pull of the heavy shell finally tears it from the shell.

Sometimes it will hang on for several days. There are great piles of the lovely pink-lipped conch shells wherever the animals are used for food. These are sold as souvenirs throughout Florida. The conch is dried for easier shipping to Northern markets.

Conch shells are used in the manufacture of porcelain and lime, and cameos are cut from them.

Cowries were used for money in British India until the end of the last century. Other uses of univalves have been given in an earlier chapter.

The Limpets — Family *Acmaeidae*

The typical limpets are generally very small, scarcely more than one inch in length. They are like an inverted bowl, oval in shape, heavily ridged from the top radiating out to the edge, which is faintly scalloped. The limpet has no operculum, and is unprotected. The animal clings to the rocks with such tenacity that it cannot be picked off by its enemies. The tongue is twice the length of the shell. When it is not sawing off seaweed or scooping out a hole in the rocks, it is neatly coiled up inside the shell. The limpet lives in the small hole scooped out of the rock. It goes about, but always returns to the same home. It has a very broad foot, which enables it to cling by suction to the rocks or to a coral reef. Many beautiful varieties are found on the western coast of Mexico in the Gulf of California. In Central America there is a giant limpet which grows to be fourteen inches wide and is used as a washbasin. The Florida limpets are small.

WEST INDIAN LIMPET (*Acmaea antillarum*)

This is a Florida species with seven to nine rays of black down the sides; tan or dull gray in color; one inch in length, and oval in shape. It is found on the Florida West Coast.

The Key-Hole Limpets — Family *Fissurellidae*

A broad cone-like shell, dull, not pearly in texture. This division of the limpets is distinguished from the pure limpets by the slit or key-hole. Its habits resemble the family Acmaeidae.

KEY-HOLE LIMPET (*Fissurella barbadensis*)

This shell is sometimes called volcano shell owing to its likeness to the ash crater of a volcano. It is about one inch long, oval-shaped, like an inverted bowl. It is found on the Florida Keys and at Charlotte Harbor on the Florida West Coast, on rocks and coral reefs. The steep cone is deeply ribbed and the ribs are evenly distributed. There is a small round hole in the top, which gives it the name. It is grayish-green in color. A similar species found in Bimini in the British Bahamas has an apple-green, porcelain-like lining.

SLIT LIMPET (*Submarginula pumila*)

This is a very long name for a tiny mollusk, less than one half inch long, found on the Florida Keys. The shell is oval, pointed, with a narrow slit at the front. The ribs are uniform and daintily beaded. It is pale green or flesh-colored.

The Top Shells — Family *Trochidae*

The shells are top-shaped, lining pearly, with large radula. The animals feed largely on seaweed, and are found in tropical seas, the most beautiful specimens coming from the Indian and Pacific Oceans. The outer limy substance of the shell is usually removed to reveal the pearly iridescent foundation. Some varieties of top shells are used in the making of pearl buttons, pearl ornaments, and necklaces.

WEST INDIAN TOP SHELL (*Livona pica*)

A heavy top-shaped shell with rounded whorl, which attains a length of four inches. In color it is pearly-green with wavy black markings, and sharp-edged aperture. The body is fringed with two long tentacles. It is found, but not in abundance, in Charlotte Harbor on the Florida West Coast. The mollusk lives on rocks and coral reefs, and is eaten in the West Indies and in Central America.

FLORIDA TOP SHELL (*Calliostoma euglyptum*)

The shell is pyramid-shaped, three fourths of an inch high, with pearly lining. The ribs are overlaid with rows of small white enameled beads, white dotted with brown and purplish spots.

The Pheasant Shells — Family *Phasianellidae*

A small tapering spiral shell brilliantly colored, with darker shades overlaying the more delicate shades. It paces in the same fashion as the top shells. Varieties found in Cuba and Florida are:

Phasianella affinis; Florida species are *Phasianella umbilicata*.

The Turban and Star Shells — Family *Turbinidae*

The Turbinidae have turban-shaped, spiral solid shells, with calcareous thick operculums and coils. They inhabit warm seas.

STAR SHELL (*Astraea longispina spinulosa*)

Marked with brown specks and streaks; one and one half inches in length. Found on both of the Florida coasts.

BROAD SPINED TURBAN (*Astraea latispina*)

Small triangular spines are found on the whorls of the shells, which are dull in color, streaked with yellow and brown. They are found on the Florida West Coast.

STONE APPLE (*Astraea tuber*)

Two inches in height and breadth; dirty white in color, with greenish or pale brown splotching. Found on the Florida East Coast.

AMERICAN STONE APPLE (*Astraea americana*)

Stony, with high cone; trifle smaller than the stone apple. Found on the Florida Keys.

The Sea Snails — Family *Neritidae*

The sea snails are a large family, found mainly in warm seas. They are easily recognized by their resemblance to the common garden snail. They have long tentacles; their eyes are quite keen and are attached to the ends of hollow stalklike projections. They are able to turn their eyes in any direction.

When in danger the eyes can be drawn through these projections to safety, under the skin of the head. Sea snails have a long radula. They live upon rocks, in shallow water, feeding heartily on seaweed.

BLEEDING TOOTH (*Nerita peleronta*)

The bleeding tooth is about one inch in length, and is found on the Florida Keys, clinging to coral reefs. The shell has zigzag bands of red, black, and purple on a white or yellow ground. The inner fold has one or two teeth-like protuberances, stained a yellowish-red, that in appearance are not unlike bleeding teeth. The animal feeds upon seaweed.

TESSELLATED NERITA (*Nerita tessellata*)

This snail is about one inch in length, and is checkered black and white. It is found at Miami and south along the coast, and clings to rocks and coral reefs.

The Staircase or Ladder Shells — Family *Epitoniidae*

These mollusks have a small white polished shell with turrets and whorls, related to the Ianthinidae. They have a world-wide distribution, many living in tropic waters; called Wentletraps. They have a protective fluid like the cuttlefish.

ANGULATED SCALA (*Epitonium angulata*)

Strong and white; three quarters of an inch in length; found on the Florida East Coast.

LINED SCALA (*Epitonium lineata*)

Thick, with brown spiral bands; one half inch in length; found on the Florida East Coast.

The Violet Snails — Family *Ianthinidae*

These are delicate, semi-transparent snails, violet-colored. They are found in both the Atlantic and the Pacific Oceans, drifting freely in schools, near the surface.

VIOLET SNAIL (*Ianthina ianthina*)

A delicate purple snail, about one inch in length. Too fragile to swim, the snail secretes a gelatinous mass into which it pushes air bubbles with its foot, forming a small pneumatic raft. By this means it stays on the surface of the water. Its eggs are fastened to the under-side of this raft. Should the snail become separated from the raft, it sinks to the bottom. Having no eyes, it protects itself from its enemies by throwing out a screen of violet ink in which it hides. Seagulls are its greatest enemies. The snail will attack a jellyfish many times its own size, biting off portions with its rasping tongue. Charles Torrey Simpson at one time came upon a great school of violet snails washed ashore at Key West. He wrote concerning them, 'Before I came to the beach, I noticed that as far as the eye could see it was a mass of the most intense glowing violet color, and on coming up to it, I was astonished to find that this color came from untold millions of *ianthinas* which had been washed up during the night.'

The Pyramid or Obelisk Shells — Family *Pyramidellidae*

Slender small spiral shells with many whorls.

OBELISK SHELLS (*Pyramidella candida*)

A rare shell that occurs in Florida.

SHORT PYRAMID SHELL (*Turbonilla curta*)

One third of an inch in length. Found on the Florida East Coast.

IMPRESSED ODOSTOMIA (*Odostomia impressa*)

One third of an inch in length. Found on both coasts of Florida.

The Moon Shells — Family *Naticidae*

The shells are globe-shaped, solid, smooth, with wide aperture, and large radula. The animals burrow into the sand for bivalves.

LITTLE MOON SHELL (*Natica canrena*)

The shell is heavy and smooth, snail-like in appearance, and is found in the West Indies, on the Atlantic Coast and the Florida West Coast. It is one to one and one half inches in diameter, and has spiral chestnut bands streaked diagonally with purple on a whitish background. The interior is dark brown shading into purple with a white edge.

DUPLICID MOON SHELL (*Polinices duplicata*)

This is a flatter, smoother shell than the typical

moon shell, and its color is pale brown slightly shaded with blue. It is about three inches in diameter, with a ruffled sand collar, and is found on both the Atlantic and Gulf Coasts of Florida.

FLAT MOON SHELL (*Sinum perspectivum*)

A flat, solid, white, ear-shaped shell, different in form and manner from the true natica. The body is exposed. The animal preys upon the oyster, and is found on the Florida East Coast.

SPOTTED MOON SHELL (*Sinum maculatum*)

A dotted species also found on the Florida East Coast, one and one half inches in length.

The Cap Shells — Family *Capulidae*

Cap-shaped shells with a spiral twist.

HUNGARIAN HAT (*Capulus ungaricus*)

This is a small shell, from one to two inches in length; almost as high as it is long. It is similar to the limpet, with the outside rough, with a twist at the top which resembles the cap worn by Hungarian peasants. It is generally white inside and out, and is attached to rocks or empty shells. It is found on the Florida Keys. The mollusk feeds on seaweed or minute animal particles.

Cup and Saucer Limpets — Family *Calyptraeidae*

The shell is limpet-shaped with slightly spiral apex. The interior is highly polished; exterior, porcelain-

like. Most of this family remain all their lives in one place, clinging firmly to the rocks and shells of their first environment. They feed upon seaweed and the bits of animal matter that come within their reach. Some species lay their eggs in a brood pouch.

CUP AND SAUCER LIMPET (*Crucibulum striatum*)

This species is found on the Atlantic Coast. The shell is less than one inch long, pale tan in color, with ridges, and resembles an inverted dome. A cup is attached to one side of the interior. Its likeness to a cup and saucer gives the shell its name. It is very rarely found on the Florida West Coast. Many lovely and varied specimens of this limpet are found at Kino Bay on the western coast of Mexico, in the Gulf of California. One of the prettiest is called the White Cap.

The Slipper Shells — Family *Crepidulidae*

Slipper-shaped shells with a shelf on one end of the inside.

SLIPPER LIMPET (*Crepidula fornicata*)

The shell is one to two inches in length, and is found abundantly on the Florida West Coast. It is oval, boat-shaped, with a seat in the stern end, and is sometimes called 'boat shell' or 'baby's cradle.' The seat is white and thin. The inside is brown, shiny, and like porcelain. The slippers fasten themselves to rocks, to an empty shell, or pile on top of each other in great clusters. They take on the shape of the object to which they are attached; hence some are flat, while others are curved.

FLAT SLIPPER SHELL (*Crepidula plana*)

The shell is about one inch long, and quite flat. The pointed end has the boat seat; the other end is broad. It is generally white, and grows, flattened out, on an empty shell, taking the shape of its support.

The Sundial Shells — Family *Architectonicidae*

These are flattened cones, with spiral markings resembling a sundial, found in all warm seas.

GRANULATED SUNDIAL SHELL (*Architectonica granulata*)

These shells are found from North Carolina to the West Indies. The surface is like china. The whorls are lavender, with white edges, marked with brown dots in even rows, with raised granules all over the surface, never larger than two inches in diameter.

The Periwinkles and Clink Shells — Family *Littorinidae*

A globular shell, spiral, turbinate, and dull. The mollusks live on the rocks at the tide line, or on roots of the mangrove, with world-wide distribution, increasing on the American coasts. They are used as food in Europe and for fish bait in America. Some varieties are becoming terrestrial.

COMMON PERIWINKLE (*Littorina irrorata*)

One inch in length, found on the Florida Gulf Coast.

ANGULATED PERIWINKLE (*Littorina angulifera*)

A variety found on the Florida coasts and in the West Indies.

ZIGZAG PERIWINKLE (*Littorina ziczac*)

One half to one inch in length, found on the Florida Keys.

PRICKLY TECTARIUS (*Tectarius muricatus*)

This mollusk, one inch in length, will live on dry land or in water. It is found on the Florida East Coast.

NODULOSE TECTARIUS (*Tectarius nodulosus*)

One half to two thirds of an inch long, dull olive-green; found on the Florida East Coast.

The Screw Shells — Family *Turritellidae*

The screw shells have long, slender spires coming to a sharp point, with many whorls. They attain a maximum length of five inches. Very few species are found in America.

VARIEGATED SCREW SHELL (*Turritella variegata*)

The screw shell has a length of two and one half to five inches, with sixteen whorls. In color it is mottled dark brown on a white background, and tapers to a needle point. The common name is 'lady fingers.'

The Sea Worm — Family *Vermetidae*

The sea worms have a tube-like spiral shell with dividing partitions, in appearance not unlike a corkscrew. The aperture is round. The animal is easily mistaken for a worm, and is found on both coasts of Florida.

VIOLET-BROWN WORM SHELL (*Vermetus nigricans*)

A violet-brown, irregularly coiled shell, which is found in masses on the Florida coasts.

WORM SHELL (*Vermicularia spirata*)

This shell resembles a petrified angleworm. It is often six to ten inches in length, and is a light tan or white in color. The spirals are close and regular at the beginning, then go off at any angle. Frequently the mollusks are found in a twisted mass. They are found in shallow water.

MODEST SILIQUARIA (*Siliquaria modesta*)

A typical pod shell of the family vermetidae found in deep waters off the Florida West Coast from Cedar Key, southward.

The Blind Shells — Family *Caecidae*

A minute spiral-shell mollusk living in warm seas. The shell becomes cylindrical with age, causing much confusion in classification.

FLORIDA BLIND SHELL (*Caecum floridanum*)

One fourth inch in length, found on the Florida East Coast.

SHINING HORN SHELL (*Meioceras nitidum*)

One tenth inch in length, found in Florida.

The Chank Shells — Family *Xancidae*

A large shell resembling the murex and voluta; heavy and fusiform in shape; sculptured and in a great variety of color. It is found in the tropics.

SPINY VASUM (*Vasum muricatum*)

A stronger species with sharp tubercles on the whorls; white lined with pink.

Family *Modulidae*

Small gray, button-shaped shells with rather strong markings.

FLORIDA MODULUS (*Modulus floridanus*)

A minute variety found on the Florida Keys.

The Horn Shells — Family *Cerithiidae*

A small spiral shell, with many whorls, notched. The animals live on rocks and among seaweeds. Only a few species are found in America, but are plentiful at Key West. They feed on decayed organic matter.

BROWN HORN SHELL (*Cerithium floridanum*)

The commonest variety found in Florida, about one inch in length, often colorless. The strong spiral ribs are set with rounded knobs.

Other varieties found in Florida include the dark horn shell (*Cerithium atratum*), *Cerithium muscarum*, *Cerithium litteratum*, *Cerithium ferrugineum*, *Cerithidia scalariformis*, *Bittium nigrum*, *Cerithiopsis punctata*, *Cerithiopsis tubercularis*, *Cerithiopsis terebralis*, and *Triforis decorata*.

The Conch Shells — Family *Strombidae*

Conchs are active mollusks found in tropical seas. They feed upon dead mollusks and crabs. The shell is heavy and porcelain-like. Its eyes are developed on tentacles, the body is muscular, and the foot very strong and well developed. By means of it the conch can pull its heavy shell along. It jumps or leaps

along. The conch of the West Coast is different from the one found on the East Coast. The large pink-lipped conch is found mainly on the Florida Keys or at Key West.

CONCH (*Strombus gigas*)

Found only in tropical waters, this conch is probably the best known of shells, as it has been widely used as an ornament in homes and gardens and as a doorstop. A large conch was used as a horn to call the farmhands to dinner on the farm of the authors' grandfather, and this same conch had its place for years on the living-room hearth. Children for generations have held the conch shell to their ears to hear the ocean roar. This is the shell of the pink-lipped conch, which is very large when full grown. They often attain a length of twelve inches and a weight of five pounds. They live among coral reefs, mainly on the Florida Keys. They eat decayed animal matter, acting as scavengers. They have a keen sense of smell and very good eyesight. The outside of the shell is rough and horny, but the enamel lining is a deep, highly polished rose. The color fades when exposed to the light. Occasionally pink pearls are found in the mantle, and, while only semi-precious, are extremely lovely. They also fade when exposed to light. Cameos are cut from this species. It makes a yellow raised figure with a rose background. The animal is strong and muscular and can pull along its heavy shell by means of the sharp foot.

This conch is used as a food, and the shell is also used for the manufacture of porcelain.

FIGHTING CONCH (*Strombus pugilis*)

This is one of the most common shells in Florida, particularly on the West Coast, where they can generally be found by the hundreds. They are three or four inches long when full grown, and have a great range of colors. The exterior is sometimes covered with an epidermis, but is generally polished. Brown forms with darker brown markings are the most common. The lining is polished and is orange, purple, white, or sometimes a deep pink in color. White specimens have rose or purple linings. One brown species has a checkered band around the swollen part of the shell. There are sharp knobs at the end of each whorl. The mollusk is able to get back into the water, with great leaps, if stranded by the tide. One collector had placed some live conchs on a mantel-piece, not knowing their ability to get about, and the next morning not a single conch remained there, but were in various parts of the room. Quite often a little crab lives in perfect harmony with the conch in its shell.

The Egg Shells — Family *Ovulidae*

These are oval-shaped, resembling the cowries with definite canals at each end.

SWOLLEN EGG SHELL (*Cyphoma gibbosa*)

Found in Florida.

POINTED EGG SHELL (*Simnia acicularis*)

Found on the East Coast of Florida.

PLICATE EGG SHELL (*Simnia uniplicata*)

Found on the Florida East Coast.

The Cowries — Family *Cypraeidae*

There are two thousand varieties of cowries and only three are found in Florida. The shell is oval or pear-shaped, highly polished, with a long, narrow aperture, which is toothed on both edges. There is no trapdoor or operculum. In life the mantle completely covers the shell on the outside. It is even more beautiful than the shell. The cowry has a large foot and a pair of eyes growing on its long tentacles. It feeds upon the coral polyp.

The cowry shells were once used as money by primitive tribes. English and Dutch traders made large fortunes by exchanging cowry shells for ivory and other valuable products.

MEASLED COWRY (*Cypraea exanthema*)

This cowry is found among the mangrove roots at Key West; it grows to a length of three or four inches. The highly polished chestnut-brown shell is literally 'broken out' with fine white dots or measles, from which it derives the name.

COFFEE BEAN (*Trivia pediculus*)

A small, pinkish-brown, button-like shell resembling a fresh-roasted coffee bean, less than one inch in length. It is polished, with three black spots on each side, and is found on the East Coast of Florida, but more abundantly in the Bahamas.

FOUR-SPOTTED COFFEE BEAN (*Trivia quadripunctata*)

Still smaller than the coffee bean shell, purplish in color, with four black dots along the middle groove. It is found on the Florida Keys.

ERATO MAUGERIAE

Found from Florida Keys west to Texas.

The Helmet Shells — Family *Cassididae*

A large, heavy univalve, found only in tropical waters. It is three-cornered; about ten inches long when fully developed, and is found on the Florida Keys. It has a horny, fan-shaped operculum, and a pair of eyes which are found at the base of the tentacles. The color is a pinkish-tan, with brown markings on the lip. Cameos are cut from this shell. The best work is still done in Italy, where it was first introduced more than one hundred years ago. Many beautiful specimens are on sale in Key West and in other places in Florida. These have generally been treated with acid to remove a covering of limy substance which completely hides the beauty of the shell. In Florida one form is called the King Helmet, another the Queen; still another, the Princess Helmet. This distinction is made according to the markings of the shells.

BLACK or CAMEO HELMET SHELL (*Cassis madagasearensis*)

This is a large shell, ten inches long, yellowish-tan in color, with dark brown markings on the ridges around the aperture. This variety is excellent for cameos because the dark layer lying beneath the light one provides a dark background for the raised figures. The shells are found on the Florida Keys or at Key West, fishermen dragging them up from the sea bottom. The helmets feed on live bivalve mollusks.

SCOTCH BONNET (*Cassis inflata*)

A rare and interesting shell, found on both coasts of Florida. One shell collector staying at Bonita Springs searched for ten winters and found only one. The shell is white, with pale brown spots, and has a diameter of four inches; a pointed top, having the appearance of a white bonnet, with head bulge and bias fold around the rim. It is heavy, and ridged. It often eludes detection in a pile of débris, where it is generally to be found.

The Tun Shells — Fig Shells — Family *Tonnidae*

A very thin and fragile shell, with wide aperture. The tuns have strong spiral ribs, and are sometimes called wine jars, because of their size and shape. They are found only in warm seas.

HELMET TUN SHELL (*Tonna galea*)

The shell is about eight inches long and eight inches wide when fully developed. It resembles a wine cask — is fragile, light tan in color, and deeply ridged in parallel grooves. It is found on the Florida East Coast.

PARTRIDGE TUN (*Tonna perdix*)

This shell is streaked with white on a brown ground resembling the feathers of a partridge; five to nine inches in length, and is found on the Florida Keys.

PAPER FIG SHELL (*Ficus papyratia*)

This very thin pear-shaped shell, generally light brown in color with a shiny lining of deeper brown, is

found mainly on the West Coast of Florida. It is very finely ribbed; sometimes nearly white with tan lining. The shells are so light in weight that they are washed high up on the beaches. They are easily recognized, and reach a length of three or four inches. There is no operculum.

The Murex Shells — Family *Muricidae*

A large family of beautiful shells found in all seas. The most beautiful and largest occur in the tropics. These mollusks are carnivorous, and a menace to oyster beds. They bore through the thickest shell with their long thin radula, sucking out the soft parts of the mollusk for their food. The sexes are distinct. The shell is spiral, tapering at both ends, and heavy. Three spiny varices cross each whorl. Smaller varices occur in between the larger ones. Most murexes have spines, knobby horns, generally long, slender, and delicately branched. The shell is solid and limy, and the lining is often a deep pink. One specimen found in the Indian Ocean or in Japanese waters is called 'Venus's Comb.' The long narrow shell with rows of spines resembles a comb. The purple dye used by the ancients was obtained from the murex. At one time this industry was so flourishing that even today great piles of crushed murex shells are found along the Adriatic. The rose murex comes from Ceylon and is bordered with a rich brown and lined with rose. A beautiful variety, *Murex princeps*, found on the west coast of South America, is sometimes five inches long. It has white ribs and the spines are brown.

SPINE-RIBBED or LACE MUREX (*Murex fuelvescens*)

The spine-ribbed murex is a handsome West Indian variety; it is also found on the Florida coasts. The length is four or five inches. A smaller specimen is found in Florida, with pinkish-brown spiral lines. The lining is white shading to lavender. The ridges look like loops of lace, crossed with pinkish-brown spiral lines.

APPLE MUREX (*Murex pomum*)

This murex is common on the Florida West Coast. The shell is yellowish-brown with a rough surface. There are three short varices, with secondary rows of smaller tubercles. The mouth is large and round; the outer lip with three brown spots. The shells are sometimes four or five inches in length, but generally are smaller. The top point is a delicate pink.

GOLDEN-MOUTH MUREX (*Murex chrysostomus*)

This murex resembles the West Indian curved-beak murex, and is two or three inches in length: a typical murex with one pronged varix. The color is drab, but the mouth is a bright orange bordered with brown. The shells are found from the Florida Gulf Coast to the West Indies.

LONGHORNED SMOKE SHELL (*Typhis longicornis*)

This is a sharp spire set with upturned tubes; one half to one inch in length, and is found on the Florida West Coast.

OYSTER DRILL (*Urosalpinx cinerea*)

These animals have a small gray shell scarcely

noticeable, and are the greatest enemies of the oyster fisheries. They bore holes in the oyster shells and suck out the pulp of the animal. Found on the Florida East Coast.

FLORIDA DRILL (*Urosalpinx floridana*)

One and one fourth inches in length, but differ from the Atlantic Coast species because of the whorled shoulder; found on the Florida West Coast.

TAMPA UROSALPINX (*Urosalpinx tampaensis*)

This species is much mixed, having the shell of the urosalpinx, the teeth of the murex, and also partakes of the ranella and purpura. It is robust with sharp ribs; one inch in length; found on the Florida West Coast.

The Purples — Family *Thaisidae*

Strong, heavily sculptured, rock-loving shells.

FLORIDA PURPLE (*Thais floridana*)

The shell is grooved and banded with black and yellow, one and one half to two inches in length, with orange lip. It is found on the Florida East Coast.

The Dove Shells — Family *Pyrenidae*

Little-known oblong shells, less than one inch in size, ridged with a whorl marked by streaks of brown and white. They are found in both warm and cold seas.

COMMON COLUMBELLA (*Pyrene mercatoria*)

Found on the Florida East Coast.

GREEDY ANCHIS (*Anachis avara*)

Found on both the East and West Coasts of Florida.

LUNAR-MARKED COLUMBELLA (*Mitrella lunata*)

Found on the Florida East Coast.

The Basket Shells — Family Nassariidae

These are small oval shells with elongated spires, with world-wide distribution. The mollusks live in warm and temperate seas, and are scavengers. They are eaten in Europe, and are also called dog whelks. They are much used in aquaria, and are dull brown in color.

WORN-OUT BASKET SHELL (*Nassarius obsoleta*)

This mollusk is abundant on the Atlantic Coast, and lives in muddy sand. It looks like a dingy battered basket overgrown with marine mould.

The Whelks — Family Buccinidae

Most members of this family are northern; the southern species are smaller.

CANCELLED CANTHARUS (*Cantharus cancellaria*)

An ash-colored variety with pronged spiral ribs, sometimes found on the Florida West Coast.

PAINTED CANTHARUS (*Cantharus tinctus*)

These shells are finely ribbed, with mottled markings of brown and white, one to one and one half inches in length. They are found on the Florida East Coast.

Trumpet Shells — Family *Neptuneidae*

This is a large family of carnivorous mollusks, found from tropical to polar regions.

LEFT-HANDED WHELK or LIGHTNING SHELL (*Busycon per-versa*)

These whelks are found abundantly on the Florida West Coast. They live in sandy shallows and burrow just under the surface for the tender mollusks on which they feed. The whorl of the shell turns to the left instead of to the right. The young shells are tan in color with zigzag lightning-like streaks. These markings fade out in the older whelk, which attain a length of five inches. The lining of the shell is a shiny brown. The animal is black. Left-handed whelks are considered sacred in the Orient. Hence many shells are shipped from Florida to India and China to be placed in the temples and used in religious ceremonies.

CHANNELED WHELK (*Busycon canaliculatus*)

This whelk is also called Giant Pear Conch. It grows to a length of six to nine inches. The interior of the shell is smooth and yellowish. The outside is covered with an epidermis. The top is deeply channeled, and the whorls are smooth, without knobs. The aperture has a sharp edge which the aborigines used as a cutting implement. From the pearly surface the Indians made wampum, and also used the shells for drinking-vessels.

PEAR CONCH (*Busycon pyrum*)

The shell has a length of four to five inches, and is

found on both coasts of Florida. The canal is long and tapering. Bands of light brown cross the white ground of the whorls. It has angular shoulder keels.

KING'S CROWN (*Melongena corona*)

This mollusk is found on the Florida West Coast. It inhabits the inlets of the Gulf of Mexico, and is not found in the open seas. The shell varies from two to five inches in length. It is dark brown in color, with a decided row of spines on the top whorl which gives it the appearance of a crown. There is a secondary row of spines near the base. Between these two rows of spines are white bands. The animal feeds upon dead crabs. Live king's crowns are caught by placing a dead horseshoe crab in a shallow place on the beach. Within an hour or two the crab will be covered with the feeding crowns. The animals are very aggressive. The method of attacking their prey (live bivalves or whelks) is unique. When the chosen victim opens its shell to breathe, the crown forces in its long black snout and destroys the controlling muscle of its prey. Rendered helpless, the victim is then entirely devoured. The coon oysters that cling to the mangrove roots are also a favorite food. The giant band shell is the only mollusk capable of overcoming the crown.

The Band Shells — Family *Fasciolaridae*

The band shells are classified with the spindles, but there are properly no spindles found in Florida, while there is a fine variety of band shells. Some bands are quite large and beautiful. These are found in shallow water, in mud flats, or just below the surface of the sand.

The long shell has an oval aperture ending in either a straight or a twisted canal. It is spindle-shaped and the finish is smooth and satiny. The body part is swollen and both ends are pointed. There are fourteen living species.

GIANT BAND SHELL (*Fasciolaria gigantea*)

This is one of the largest of univalves, and grows to a length of one to two feet. The shell is very heavy. It is yellowish in color and covered with a horny brown epidermis. The aperture is a reddish-orange of solid color.

TULIP BAND (*Fasciolaria tulipa*)

This shell is so called because of its resemblance to a tulip. It grows to a length of from four to eight inches. This is the dark mahogany or bright plain orange-colored form. The mollusks feed upon dead crabs and other dead mollusks.

PALE TULIP (*Fasciolaria distans*)

The most common tulips are a pearly gray with almost shadow design in white, with delicate, perfectly penciled lines in dark brown or black banding it in parallel lines.

The Volutes — Family *Volutidae*

These are carnivorous mollusks living at great depths in tropical and sub-tropical waters, mainly in the Southern Hemisphere. These are the aristocrats of the shell family. The beautiful and handsomely marked American species are highly prized.

JUNONIA (*Maculopeplum junonia*)

This mollusk is found only on the Florida coast. The beach most famous for this rare and deep-sea mollusk is Sanibel Island, off the coast at Fort Myers, on the Gulf of Mexico. The creamy white shell of a slim spindle shape is marked with spiral rows of squarish brown or orange spots. The lip is thin and has a porcelain-white lining. A perfect specimen, at one time, was worth two hundred dollars. At the present the average price varies from five to thirty dollars, depending upon the perfection of spots and polish. It has a length of three to four inches. It is generally found after a storm. The best specimens are not found in the piles of débris on the beach, but are uncovered from the sand.

The Margin Shells — Family *Marginellidae*

These mollusks have a small shell resembling the cowries and are related to them and also the volutes and mitres. They live in tropical and sub-tropical waters.

POINTED MARGINELLA (*Marginella apicina*)

Found on the Florida East Coast.

RUDDY RUM SHELL (*Marginella carnea*)

Found from Tampa Bay to West Indies.

SPOTTED MARGINELLA (*Marginella guttata*)

Found on the Florida East Coast.

The Olive Shells — Family *Olividae*

This family has an oblong shell, thick, highly polished, porcelain-like; without epidermis; aperture long. It varies from one and one half to two and one half inches in length. It has dual picturing; that is, one decorated layer is laid on top of another layer of entirely different design. The olive mollusk is able to dissolve an earlier-formed spiral scroll of the shell and give itself more room. The shells are written over in zigzag lines of brown. These handsome mollusks are tropical, and live in sandy flats. They move quickly and burrow under the sand at low tide, leaving no trace. They are covered by the mantle which is even more brightly colored than the shell itself. This mantle can be drawn into the shell if the animal so desires. It also has a chameleon-like ability to change color with its change of environment.

Charles Torrey Simpson writes in *Beautiful Florida* (volumes 4-11, March, 1928 — December, 1931): 'I lived on the West Coast of the State for two years and never found but a few dead shells (olivas). One day on a sandy beach I saw something move, and after digging it out it looked like a piece of fat pork. It squirmed about until it became much smaller, and I saw in my hand a splendid oliva shell into which it had drawn. These mollusks come to the surface, covering the shell with the foot and plowing along in the sand. They are always exactly the color of the material in which they live; if it is white, the foot is white; if yellow or black, the animal is yellow or black. One wonders why these shells should be so

beautifully marked and then absolutely concealed from sight.'

LETTERED OLIVE (*Oliva sayana*)

The lettered olive is one and one half to two and one half inches in length. The shell is slender and tapers toward both ends, a beautifully polished light brown with lettered effect in darker brown. The mollusk is found alive, burrowed into the sand, on the West Coast beaches of Florida. They live in colonies, and have been seen alive on the beaches of Marco Island, which is situated off the Florida West Coast. The shells are the so-called 'Panama Shell.' They are often strung and used as portières.

NETTED OLIVE (*Oliva reticularis*)

This olive is from one to two inches long, and is found mainly on the Florida East Coast. The shell has a lace pattern of fine brown lines on a white ground.

RICE SHELL (*Olivella mutica*)

The rice shell is a small delicate spiral species about one half inch in length. The shells are banded, whorled, translucent, tapering at both ends. They are found on the Florida East Coast.

The Auger Shells — Family *Terebridae*

These shells are a long, tapering spiral found in warm seas. There are many whorls, mottled with brown on a drab surface.

DISLOCATED TEREBRA (*Terebra dislocata*)

Grayish or yellowish-brown in color, one to two inches in length, with a beaded band on the whorl, found on the Florida East Coast.

AUGER SHELL (*Terebra protexta*)

A china-like brown shell, with convex whorls, found on the Florida West Coast.

The Cone Shells — Family *Conidae*

These shells are most easily recognized because of their cone shape. The shell is heavy and porcelain-like. The opening of the shell is long and narrow, and the shells are variously marked. They are highly prized by collectors, and are among the highest-priced shells. The cones feed on other mollusks by boring holes through the shell with their tongue and sucking out the soft parts. Some species in the Indian Ocean and the China Seas have poisonous teeth. When attacked, they strike at their enemies. There are more than four hundred living species. In the islands of the Pacific the natives use cross-sections of the great white cones as armlets.

The cone has the ability of resorbing some of the inside whorls, thus making more room for itself as it grows. It then uses the substance obtained to build onto the outside of the shell. The most valuable cone is found in the Philippines and is called 'The Glory of the Sea' (*gloria maris*). Not many more than a dozen of these have been found, and most of them are in European museums. Just a century ago Hugh Cuming, noted English shell collector, found three

live specimens on a coral reef in the Philippines. A short time later during an earthquake this reef sank into the sea. No more have been found. These are almost priceless in value.

CHINESE ALPHABET (*Conus proteus*)

This is a smooth white shell, one and one half to two and one half inches long, not polished, with rows of characters in brown or orange that resemble the letters of the Chinese alphabet. This gives the shell its common name in Florida. The shell is a perfect cone with a flat top. No living specimens are found. The empty shells are washed up on the beaches, and many beautiful ones can be found by patient searching. The opening is long and narrow. They are found on the Florida West Coast.

FLORIDA CONE (*Conus floridanus*)

Peale's cone is found on the Florida West Coast and in the Bahamas. It is small, scarcely one inch in length; in color a deep yellow, with white bands. The shell is slender with a higher peak than the Chinese alphabet. The aperture is long and narrow.

MOUSE CONE (*Conus mus*)

A Florida variety with turbinate spires and body whorl banded with white and streaked with chestnut. Sometimes cloudy blue with green stains near the base. It is one to two inches in length, and is found on the Florida East Coast.

The Cross-Barred Shells — Family *Cancellariidae*

These are small, roundish, cross-ribbed shells. The animal is a vegetable feeder, and is found on the Florida West Coast.

CROSS-BARRED or NUTMEG SHELL (*Cancellaria reticulata*)

The shell resembles a nutmeg, in shape, color, and roughness of texture, and is small, one and one half to two inches in length, white, with brown bands or spots. The ridges are cross-barred and deeply cut. This gives the shell a granulated surface. It is heavy and spherical, with both ends pointed.

NARROW NUTMEG SHELL (*Cancellaria tenera*)

A tropical cross-barred shell about two thirds of an inch in length found at Cape Sable, Florida.

The Bubble Shells — Family *Bullidae*

This family has thin, smooth, shiny shells; pale tan in color; small, seldom one inch in length. The animal swallows small bivalves whole and grinds them to bits against the strong walls of the gizzard.

FLORIDA BUBBLE (*Bulla occidentalis*)

A thin oval shell with mouth as long as the shell, found on sandy beaches in southern Florida. It is pale tan with indefinite design in darker brown, one half inch in length.

The Siphon Shells — Family *Siphonariidae*

Minute marine mollusks living chiefly in the

tropics. They attach themselves to rocks at the tide line.

ALTERNAL SIPHON SHELL (*Siphonaria alternata*)

This shell has a pointing beak; brown with branching lines of white; three tenths of an inch in length. It is found on the Florida East Coast.

V

ARMED MOLLUSKS OR CEPHALOPODS

THIS small group of mollusks, more than any other, has furnished sea legends and myths since the days of Aristotle. The giant squid is doubtless the ancient sea serpent, which even today occasionally makes the headlines.

Classical literature and ancient scientific lore are replete with tall stories of the terrible squid. Some accounts claim that giant squids rose up from the sea and, wrapping their great arms around the masts of vessels, drew them beneath the waves to their doom. These tales are now considered only so much rhetoric.

The octopus, commonly called devilfish, has had many terrifying stories about it. Divers, fishermen, and sailors are reported to have had harrowing encounters with these monsters, but in the interest of truth it must be said that these tales are largely imaginary. Naturalists claim they are harmless; in fact, to be extremely timid. They are able only to fasten themselves to solid bodies. This they accomplish by the pressure exerted by suckers on their legs. If these suckers touch the naked skin, one suffers from severe irritation. They will not bite

human beings, but may spray them with an inky substance called 'sepia.' This ink is caustic and produces an unpleasant stinging sensation. Victor Hugo, in *Toilers of the Sea*, has written a graphic account of a fisherman's battle with an octopus. There are no facts to support his story, but it is considered a classical sea yarn.

Except for the chambered nautilus, none of this group has an external shell. The mollusk shell is its fortress and protection, and without it, the head-footed mollusk has developed greater agility, keenness, and strength. They are the most intelligent of all groups, and the most highly organized. Head-footed aptly describes the great head surrounded with a fringe of arms. The octopus has eight arms, all alike. The giant squids, cuttle or sepia, and tiny spirula have ten arms. The chambered nautilus has many arms. It has four gills. All other forms have two gills.

The octopus and squid and the cuttle or sepia have a gland which secretes an inky substance. This ink is dark brown and thick. It is secreted constantly and stored up in the body of the animals. A small amount will color a large volume of water. When angry or frightened, these creatures discharge the ink, clouding up the water surrounding them, and escape from their enemies in a smoke screen. This ink was once the basis of the India ink and sepia water color used by artists. The octopus, normally a dusky brown, is able to change color more rapidly and through a greater range than any other animal. When frightened, it blanches white, and when angry,

it turns a dark reddish purple. At other times it can harmonize with its background.

The giant squids emit light. They have been observed, softly glowing, in the great depths where they live. As only live creatures give off light, not much is known about this phenomenon, but it is known that some have great brilliance. It appears that this light is only emitted in the dark depths of the ocean where the squid needs it in order that it may move about freely. The light is not observed near the surface of the ocean nor is it present in the dead specimen.

The tiny spirula has a bead-like organ in its head that throws off a pale yellowish-green light. This light appears to remain constant for hours. These creatures travel by means of a remarkable funnel installed in the lower part of the head. Through this funnel water is rapidly expelled from the mantle cavity. The force of this expulsion propels them with great speed in a backward direction.

The sexes are always distinct. The female is usually larger than the male. The female argonaut is fifteen times the length of the male.

The body of all members of this family, except the chambered nautilus, is comprised of head, arms, funnel, and trunk containing the organs. The eyes are a prominent feature of the head. They are always cruel, prominent, and malignant. The arms or tentacles are equipped with small suction cups or suckers. Sometimes as many as eighty suckers are present on each arm. These suckers hold the creatures fast to any support they may choose.

Geologists have unearthed the fossils of gigantic prehistoric cephalopods. They were much larger and much more abundant than those of the present time.

All cephalopods are carnivorous and prey upon crabs, mollusks, and fish. Octopuses have been known, when very hungry, to turn cannibal. Their dens are strewn with empty shells and the remains of countless crabs.

This group is generally characterized by ferocity, speed, and strength.

The Octopus or Devilfish — Family *Octopodidae*

This family is found in warm and temperate seas, with very large head, prominent eyes, eight uniform arms, two rows of suckers to each arm; and a mantle braced with two strong muscles.

OCTOPUS or DEVILFISH (*Octopus vulgaris*)

Very little is known concerning the rate of growth or the age of the octopus. It is estimated that those with arms three feet long have reached the age of three or four years. It is a solitary creature, living in rocky grottoes in fairly shallow water in temperate or warm seas. It lies with outspread arms, taking on the color of the surrounding rocks, waiting for a hapless victim to come within reach. Its eight arms are all alike, and each arm, though it has no bony support, is often as large and as powerful as a boa constrictor.

The octopus goes abroad at night to seek its food. It slides along with the arms flattened out and the

body upheld. It has been seen to walk on the tips of the arms like a toe-dancer. When it swims, the trunk is thrust forward, head down, arms trailing behind. In the species *Eledone* the arms are webbed and used as a parachute to drift down to the bottom of the ocean. If an arm is lost, another is grown to replace it. The arms are especially sensitive to touch. In fact, the whole surface of the body is exceedingly sensitive.

The eyes are baleful and malignant with a long horn above each. Even when observing them in aquaria, one is struck by their terrifying intensity. This no doubt gives rise to the fear the average person feels for octopuses.

The octopus feeds largely on mussels. It will collect a great many before it begins to feed. The food is placed in the mouth by the arms. There the powerful jaws and the radula, a tongue set with sharp teeth, grind the food to bits.

The eggs are deposited in semi-transparent horny cases, each end of which is lengthened into a string. A number of these cases are fastened together by the strings. This bunch is then attached by the female to a rock. About eight hundred eggs are deposited at one spawning.

The octopus is used as food in the Mediterranean. It can be caught with bait, but the oldest method is that of lowering earthen jars. The octopuses climb inside the jars and can then be drawn to the surface. Tobacco is sometimes lowered to the dens of the octopus to dislodge them so that the fishermen can catch them.

Whalers feared the Giant Octopus much more than they did the whales. Herman Melville, himself a whaler, has given us his description of a giant squid in *Moby Dick*. He wrote: 'We now gazed at the most wonderful phenomenon which the secret seas have hitherto revealed to mankind. A vast pulpy mass, furlongs in length and breadth, of a glancing cream color, lay floating on the water, innumerable long arms radiating from its center, and curling and twisting like a nest of anacondas, as if blindly to catch at any hapless object within reach. No perceptible face or front did it have; no conceivable token of either sensation or instinct; but undulated there on the billows, an unearthly, formless, chance-like apparition of life.'

The Common Squids — Family *Loliginidae*

The common squids have a body eight to twenty inches in length. They are found on the Atlantic Coast from Maine southward, and are used as fish bait.

THE COMMON SQUID (*Logilo pealeii*)

This squid is sometimes seen in Florida waters. Fishermen tell of seeing its torpedo-like body flashing through the water in backward fashion. It strikes at the fish and tears off pieces with its beak. It is a typical squid with all the qualities and characteristics of the family.

The Giant Squids — Family *Ommastrephidae*

The giant squids have a wide distribution. Their great arms, when raised above the water, resemble

sea serpents. They are found in the North Atlantic. They are free swimmers and usually live at great depths. The squid is allied to the molluscan family by the radula and the mantle.

THE GIANT SQUID (*Architeuthis harveyi*)

Squids have been found fifty-five feet long, with arms thirty-five feet long and body twelve feet in circumference. The ten great arms, two much lengthened, have suckers with horny rims. The largest suckers reach a diameter of two and one fourth inches. This gives some idea of the tremendous size and power of these creatures.

The squid seizes its food with its arms. The prey is held fast by the vacuum suction of the suckers. It is then carried to the mouth by the arms. The gluttonous animal swallows as much as it possibly can at one time.

The squids are the swiftest creatures in the animal kingdom. They flash through the water, backward or forward at will.

There is only one enemy that can conquer these great monsters of the sea. That is the whale. Whales have been captured with great sucker scars on their sides, showing that they did not get away entirely without injury.

The Cuttle Sepia — Family *Sepiidae*

The shell of this mollusk, six to ten inches in length, is internal, porous, and chalky white. The

'cuttle bone' commonly found in canary cages is a small piece of this shell. The animal is only a trifle longer than the shell, with short head, large eyes, and ten arms, with world-wide distribution. It is used as bait. In some localities it is eaten. The bone is also used in compounding toothpowder.

THE COMMON CUTTLE (*Sepia officinalis*)

The sepia is often mistakenly called 'cuttlefish.' The animal is brilliantly iridescent, and can change color for protective purposes. It inhabits the warm shallow waters of Europe. The cuttle secretes a black inky substance once used as the base of India ink. The sepia used by artists and printers was formerly derived from this ink.

The Argonaut or Paper Nautilus — Family *Argonautidae*

There are five species of this family. The shell is thin, flattened, semi-circular canoe-shaped, spiral at one end; fragile white in color, shadowed with yellow, and ornamented with small knobs and swollen veins. The shell is not attached to the animal, but is clasped in its arms and held above the body. The argonaut has eight arms provided with suckers on small stalks. It crawls about on the ocean floor, coming to the surface only during the summer. The shell is secreted by the female only and its main purpose is to cradle the eggs. The female is large, six to twelve inches in diameter. The male is small, only about one inch in diameter, and entirely without a shell. It is found in all tropical waters. The shells are prized by collectors.

PAPER NAUTILUS (*Argonauta argo*)

The shell is found on both Florida coasts. It is typical of the family and the best-known of the species. Classical literature is full of allusions to this shell. It is named for the fabled ships of Jason that went in search of the Golden Fleece. Sailors consider them a sign of fair weather and favorable winds. This is understandable when we remember that the female only bears the shell and comes to the surface at breeding time. The eggs are laid in this cradle and fertilized in a unique manner. One arm of the male is modified to carry the spermatozoa. This arm is detached by the female and hidden in her mantle. When the eggs are fertile, the useless male arm is discarded. The eggs are covered with a viscous substance and pushed into the egg cradle. They look like tiny bunches of grapes. As the mass grows larger, it pushes the nautilus out of the shell. She then grasps the shell in her arms and floats with it to the surface, where the eggs hatch and the young swim away. The male does not follow her to the surface.

Live argonauta have been found on the Florida coast.

The Chambered Nautilus — Family *Nautilidae*

The shell is boat-shaped, flattened, whorled, chambered, and is of world-wide distribution. Most of the species of this once large family are extinct. The presence of fossil Nautilidae has been extensively observed.

CHAMBERED NAUTILUS (*Nautilus pompilius*)

This is, according to Oliver Wendell Holmes,

‘... the ship of pearl, which, poets feign,
Sails the unshadowed Main;’

but there is little evidence to support his claim, as the animals are known to stay close to their original home. They live in warm seas at great depth, rarely coming to the surface. The Philippine Islands and other neighboring islands of the South Pacific are the homes of the largest number of them. The shell is flat with only a few whorls, four to six inches in diameter, yellowish, cross-banded with brown, pearly iridescent within. Opposite the opening there is a patch of black. A narrow band of black lines the edge of the shell. The species is called ‘chambered nautilus’ because of the manner in which the shell is constructed. As the animal grows, a larger chamber is added to the shell to accommodate it. The animal always lives in the last chamber, but a central tube passes through the entire shell back to the first chamber. In some manner, not quite plain, this tube is used to admit or withdraw air from the shell. This permits the animal to come to the surface or lightens its burden when crawling about for food. The animal has four gills. The male has sixty arms, the female ninety. The body is pure white. The head has a horny beak and a rasping tongue. Its eyes are constructed like a camera lens, such being needed at the great depths in which it lives. It feeds mainly on crabs, crawling along the bottom of the ocean in search of them.

The nautilus is caught in fish traps and brought to the surface. There is no local demand for the shells, but many are exported. In Paris they are used in making fine pearl ornaments and in finer cameo-cutting. In India they are used as drinking-cups. In America they are prized for the shells alone, though often they are made into lamps or decorations for shop windows. It is not uncommon to see shells that have had the outer coating removed and only the pearl inner lining left. Nautilus shells are expensive, and one should use care in buying them, as the dead and almost worthless shells have often been cleverly restored.

The Spirula — Family *Spirulidae*

The shell is about one inch in length, with pearly lining, spiral, and chambered. This delicate little shell is the internal shell of a little-known member of the head-footed mollusks. The animal has ten short arms set with suckers, a large head, and prominent eyes, and lives in deep tropical waters.

SPIRULA (*Spirula spirula*)

Tiny little white chambered scrolls are often found on Miami Beach. These are shells of the spirula. The chamber partitions are much heavier than the outside walls. They have been thrown up from the deep tropical waters and washed ashore. Only the empty white spire is found; the animal does not come to the surface.

VI

TOOTH SHELLS OR SCAPHOPODS

THIS class is a low-type organism found only in salt water. They are not well known and not much study has been given to their habits and their structure. They are to be found in nearly all seas. They live in both shallow and deep waters, burrowing in the sand or mud. They move about little, and remain in one location all their lives. The long, pointed foot is of the burrowing type. The only way the animal can move is in a slanting, downward direction. That is why it is called 'plow-footed.' The tooth shell dives head first into the sand and leaves the small rear end sticking out into water. It has no eyes, since its head is in darkness and it would have no need of them. The shell is secreted by the mantle, and is tube-like, open at both ends. It is curved and resembles the tusk of an animal. There are no bright-colored ones. Most of the shells are smooth and curved, but some are ribbed, one to five inches in length. The mouth at the base of the foot contains the radula. Filaments for grasping food are at the corners of the mouth. The mollusk lives on tiny organisms and minute plants.

The shells were once used as money by the primi-

tive Indian tribes. Ornaments and necklaces were also made of them. The American Indian valued the tooth shell highly as a part of his wealth. The money tooth shell (*Dentalium pretiosum*) is found on the Pacific Coast north of California. The tusk shell money of the aborigines of the Pacific Coast corresponded to the wampum of the Indians of the Atlantic Coast. The early traders cleverly exchanged this shell money with the Indians for California's gold. Remote Alaskan tribes have shell money in circulation today. The angled tooth shell (*Dentalium hexagonum*) comes from the California Coast. The elephant-tusk shell (*Dentalium elephantinum*), curved and tapered like the tusk of an elephant, comes from the Orient. It is dark green in color, fading out to white.

Quite a number of species of tooth shells are found in Florida. On the New England coast a common white variety is found. The most beautiful ones come from the Adriatic and the Orient.

VII

OTHER CREATURES OF THE SEA

THE seashore has many curious creatures besides the inhabitants of shells. Many of these creatures are always present and excite as much interest as the shells themselves. For this reason a group of brief descriptions of the most common ones has been added.

They are classed in the animal kingdom as belonging to the Protozoa, Porifera, Coelenterata, Ctenophora, and Echinodermata. Also a number of other oddities among crustaceans.

Space will not permit even the simplest discussion of so vast a field, but the representatives one is likely to find on the beach are here treated as individual representatives of their class and kind.

Plants

GULF WEED (*Sargassum bacciferum*)

This is a highly differentiated marine plant growing on the surface of the Caribbean waters and carried northward by the Gulf Stream. It is golden bronze in color, with branched fronds with foliated leaves. It bears small berry-like air floats, and is poetically called 'cloth of gold.'

SEA LETTUCE (*Ulva lactuca*)

A common marine plant with wide-spreading leaf that resembles the lettuce leaf.

SEA BEAN (*Mucuna urens*)

The oval brown seed of the West Indian climber often washed up on the Florida coasts; prized as a lucky souvenir.

Sea Fire

This is the brilliant phosphorescence observed at night on tropical waters, produced by shoals of millions of microscopic luminous jelly globules, swimming on or near the surface of the sea. The life history and purpose of these are largely unknown.

The Sponge — *Porifera*

The sponge is the elastic porous mass of horny fibers which forms the internal skeleton of certain marine animals of low organization belonging to the branch of the animal kingdom known as *Porifera*. Most commercial sponges grow at a depth of less than one hundred and thirty feet. There are only a few recognized kinds used by man. The sponges wholly useless to man number thousands of species. These useless skeletons usually contain high percentages of siliceous spicules or carbonate of lime.

The commercial sponges of Florida come mainly from the Gulf of Mexico and the Straits of Florida, extending from Key West to St. Marks's Light near Apalachicola. They grow at depths of from ten to one hundred and thirty feet, and reach from one to fifty miles from shore. The Tarpon Springs fishing

fleet is comprised of nearly one hundred boats. The fishers are mainly Greeks, who follow the calling of their ancient ancestors. In shallow water (five to six feet) they spread oil to calm the surface and locate the sponge through a glass-bottomed bucket, and grapple it up with a sponge hook. Divers go down one hundred and twenty-five feet, and machine diving is safe at one hundred and fifty feet. A record of two hundred and one feet has been made. Ten years of diving is almost the safe limit for this kind of work.

The Florida sponge industry began about 1905 and about 9300 square miles of sponge-producing area is worked.

The age of sponges is gauged by their size. They must be bleached in a solution of permanganate of potash before they are marketable.

During the past thirty years more than twenty million dollars' worth of sponges have been shipped from Tarpon Springs.

GLOVE SPONGE (*Euspongia officinalis*)

This is also called the reef sponge, and comes from the shallow waters of the Bahamas and Florida. It is distinguished by round holes, each bordered by a circular ridge. The fiber is more brittle than the Levantine sponges because of the free lime in the water.

GRASS SPONGE (*Hippos spongia equina cerebriformis*)

An inferior commercial sponge found in Florida. It has the form of a truncated cone fluted with deep furrows.

VELVET SPONGE (*Hippos spongia equina meandriniformis*)

This is a fine soft commercial sponge found in Florida waters. It comes nearest in softness to the Turkish sponges.

WOOL SPONGE (*Hippos spongia gossypina*)

This Florida sponge corresponds to the bath sponge of the Mediterranean. It reaches commercial size in one year and is considered one of the finest sponges in the world. The surface resembles lamb's fleece. The sponges when found are dingy gray. They undergo considerable treatment before they are ready for market.

The Corals and their Allies

The compound calcareous skeletons of the various actinozoa and a few hydrozoa; also the animal that produces this skeleton. The stony coral that makes up the reefs of tropical seas belongs to the *Madreporaria*, although some belong to the *Millepores*. See also Millepore of Florida.

SEA FEATHER (*Virgularia grandiflora*)

A plume-like gorgonian of brilliant design, somewhat resembling the sea pen.

SEA FAN (*Gorgonia flabellum*)

A gorgonoid coral that branches in fan form; native to Florida and the West Indies.

SEA PENS (*Pennatula phosphorea*)

A plume-like gorgonian, named because of its re-

semblance to a quill pen or ostrich feather. It is highly luminous.

MILLEPORE OF FLORIDA (*Millepora alcicornis*)

A coral of the genus *Millepora* of the order Hydrocorallina of the class Hydrozoa. It has a smooth surface, with small perforations for the zooids. It has branching, encrusting, or foliated forms. The masses are often of large size. This is an important reef-building coral. The genera are numerous. A few of the more ornate ones are described under the heading CORAL.

JELLYFISH (*Medusae*)

Any of the numerous marine free-swimming Coelenterates having a transparent body of jelly-like consistency. Most of the familiar forms belong to the order Discomedusae of the class Scyphozoa. They are usually umbrella-like in shape with tentacles. They move by body contraction. They develop directly from the egg or with intervention of a transverse division process. Called sea blubber, seacross, and sea jelly.

SEA ANEMONE (*Actinaria*)

Any of the numberless varieties of polyps of the genus *Actinaria* of the class Actinozoa. The forms are bright and colorful, often resembling flowers, and are called by the names of many flowers, such as sea marigold and sea sunflower. They nearly always appear separately. They have no skeleton, and gather their food with tentacles that have stinging cells.

BRANCH CORAL (*Madrepora prolifera*)

A stony coral with many branches radiating from a common center. A reef-builder found in Florida waters.

BRAIN CORAL (*Coeloria*)

A coral of the group Fissiparantes of the genera *Coeloria*. The surface of the coral presents a series of bent or curved grooves, each with a row of slit-shaped mouths, giving the appearance of the convolutions of the brain.

STAG HORN CORAL (*Madrepora cervicornis*)

A long branching coral, resembling deer antlers, one of the reef-building corals found in Florida waters.

PORTUGUESE MAN-OF-WAR (*Physalia physalis*)

A member of the family of sea nettles (Acalephae). A bright blue, pink-tipped balloon sailing on the surface of the calm sea. Long filament trailers provided with poison cells cause intense and long-lasting pain if picked up or struck when swimming. Sometimes called sea bladder.

Echinodermes

STARFISH OF FLORIDA (*Asterias forbesii*)

A spiny skinned echinoderm of the class Asteroidea or common starfish. It is distinguished by the bright orange button (madreporite) on the central disk at the union of two rays.

SEA URCHIN (*Tripneustes esculentus*)

A spiny skinned echinoderm of the class Echinoidea, with variously shaped shells bearing numerous movable spines. It is found in all seas and is called by such names as sea hedgehog, sea porcupine, sea chestnut, and sea egg. Some varieties are boiled and eaten from their shells. It lives buried in the sand, among the rocks, and on the sea bottom, and feeds on small organisms and animal refuse.

SEA BISCUIT (*Clypeaster rosaceus*)

A clypeastrid sea urchin sometimes called heart urchin; also called Sea Bun.

SAND DOLLAR (*Mellita quinquiesperforata*)

A flat, thin, keyhole or shield urchin; pierced with five slits resembling keyholes.

SEA CUCUMBER (*Cucumaria frondosa*)

A fat purplish worm-like spiny skinned echinoderm living in shallow water on sandy bottom; also called sea gourd, sea pumpkin, or sea gherkin. It belongs to the class Holothuroidea.

Crustacea

SAND FLEA (*Orchestia platensis*)

A small amphipod crustacean living at the tide line. They are the most active of the shore scavengers; splendid as pompano bait.

THE BARNACLE (*Cirripedia*)

Any of the numerous marine crustaceans of the order of Cirripedia. The larvae are free swimming.

The adult is fixed. A calcified shell of several pieces protects the adult. It fastens itself to rocks, floating timbers, and ships' bottoms, etc.

ACORN BARNACLE (*Balanus eburneus*)

A small, conical, sessile barnacle sometimes called acorn shell, because of the resemblance to that nut. It is known also as the sea thorn.

GOOSE BARNACLE (*Lepas anatifera*)

A stalked barnacle with shell resembling a flatted cone, at the top of a neck-like body. Legend claims that it took its name from the bernicle goose said to have sprung from this shellfish.

SAND CRAB (*Cancer irroratus*)

A marauding crustacean with powerful claws, which feeds on mussels.

SPIDER CRAB (*Libinia emarginata*)

A large, spiderlike crustacean; a vegetarian night-feeder. It is the largest of the true crabs.

HERMIT CRAB (*Pagurus longicarpus*)

A decapoid crustacean of the family Paguridae. It is found on the Atlantic Coast. It has an elongated body and soft abdomen. It occupies the empty shell of gastropods, abandoning it as it grows larger. Males are great fighters, having strong pincer claws. The hermit crabs are usually marine; some are terrestrial.

FIDDLER CRAB (*Uca pugilator* and *Uca minax*)

Two species of this genus of burrowing crabs living in mud or sand holes just at the tide line. The male has one enlarged claw carried aloft, as a musician would hold a fiddle. It is a scavenger, both vegetarian and carnivorous, eating only fresh food. It is the favorite food of the great blue heron. The heron stands over the holes where the crabs hide and snatches them up if they come outside.

KING CRAB (*Xiphosura polyphemus*)

A species of the large marine arthropods living on the sandy and muddy bottoms of the Atlantic Coast. It grows nearly two feet long, and is also called Horseshoe Crab. It has a broad body, armored with long spikes on either side, and holds its tail like a spear.

Tunicata

PYROSOMA (*Pyrosoma atlanticum*)

A pyrosomoid tunicate swimming near the surface, mostly in tropical water. It is brilliantly phosphorescent.

Fish

SEA HORSE (*Hippocampus punctulatus*)

A small fish covered with horny plates, having a head and body resembling a horse and a prehensile tail. It swims upright.

APPENDIX

I. COLLECTING SHELLS

SPECIMENS for a shell collection may be bought, but it is much more fun to gather them. There are a few necessary items to be provided for a day of shell collecting.

1. Several medium-sized cardboard boxes to hold the shells.
2. A small basket or tough paper bag to be used when collecting.
3. A pair of rubber beach shoes to save wet and uncomfortable feet and to aid in walking on the sand.
4. A blanket or beach robe to rest upon.
5. A large sun hat or pith helmet. The head should be protected from the noonday sun.
6. Plenty of cool water, preferably in thermos bottles. There is rarely good drinking water handy.
7. A simple lunch, as good food may not be available.

When collecting, it is best to gather shells in small quantities and empty them often into the boxes, as shells are heavy to carry any great distance and crush easily. In this manner the shells can be easily sorted and those of one kind kept together. Put fragile shells — starfish, urchins, and crabs — into a separate container. Keep only perfect, highly colored specimens. Shells are much brighter when wet and many will be dull and unattractive when dry. Broken or bleached shells are worthless. Only a little experience is necessary to develop selectivity.

II. MOUNTING SHELLS

THE best way to preserve and display a collection of small shells is to mount them on cardboard. These display cards are called shell charts. These charts are useful for nature study in schools and libraries, and mounting the shells is a splendid hobby.

After the shells have been sorted into like kinds, the sand should be carefully brushed from them. It is not necessary to wash them. They will be clean when the sand has been removed and the shells polished with a soft cloth. A drop of olive oil rubbed into a shell often improves its appearance.

Choose a heavy, not too flexible, smooth cardboard. A convenient size for finished charts is 11 × 14 inches. This size gives space for forty to fifty shells. The color of the cardboard is important. It is best to choose a color that blends well with the delicate hues of the shells or else one that forms a pleasing contrast. Black, deep yellow, and orange are excellent colors to use. Do not use a cardboard that fades or soils easily. Tan may be used, but other more violent colors tend to lessen the brilliance of the shells.

Shells of one kind may be used to make a whole chart, or a combination of a number of specimens will be both useful and attractive. In making a mixed chart, choose a small, thoroughly dried starfish, sand dollar, or other oddity, and place it in the center of the cardboard. Then choose five or six pectens, or other small shells of different sizes and shades, and make a border of them at the top or bottom of the card. Other shells may be placed to suit the individual taste. Observe the effect, and if not entirely satisfied, try another arrangement. A few experiments will develop skill in arrangement, balance, and pleasing color combinations. Do not glue a single shell until the arrangement satisfies. Avoid a lopsided effect. Leave room for a label under each shell. Labels can be typed, single-spaced, on a sheet of gummed paper. Make the labels as narrow as possible. Do not put several long-named shells together, but distribute them evenly over the card. It gives a more balanced appearance. Use liquid cement for gluing. This type of glue is the most satisfactory because it is colorless, hardens quickly, and is put up in convenient

tubes. Use plenty of glue, but wipe off the excess so that it will not spoil the looks of the chart by drying in unsightly daubs. On the flat bivalves spread the glue around the outside edges. The cockles have a tendency to slip and will have to be pulled into place frequently while drying. Place the shells neatly in even rows and avoid a careless effect.

Making shell charts is more than merely pasting specimens on a cardboard. It develops skill in color combinations, trains the eye to observe form and line, teaches a knowledge of shells through naming and classification, and gives each one an opportunity to work out his own ideas of beauty in arrangement.

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